Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

May 29, 1943 — Vol. 119, No. 22

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Please change my address on Electrical World

From .....

.....

To .....

.....

Signed .....

A BREAK IN THE ELECTRICAL CIRCUIT

MEANS A BREAK IN WAR PRODUCTION!

Conditions under which electrical circuits must operate in industrial plants, such as proximity to steam lines, boilers, furnaces, drying ovens, electroplating and in other places where resistance to heat, moisture, corrosive fumes, oils, grease and even fire, require the selection of insulated cables that will stand up under such severe service conditions. Okolite-Okoprene cables,* for instance, have successfully demonstrated their reliability in every type of industrial plant operation.

There are other Okonite cables that may solve your problems. Okonite sales engineers are experts in the selection, installation and maintenance of electrical cables. They are also able to give the answers to such questions as: (1) what cables are now available; (2) priorities; (3) government restrictions and limitations; (4) deliveries. They can tell you how to prolong the life of existing cable installations. Bring your electrical cable problems to Okonite ... The Okonite Company, Passaic, N. J. Offices in Principal Cities.

*OKOLITE-OKOPRENE—insulated with Okolite and protected with an Okoprene sheath. Resists moisture, heat, ozone, sunlight, oil, chemicals and flame. No lead sheath required. No braids to rot. High current carrying capacity and breakdown voltage. Low specific inductive capacity and power factor. Available in colors for circuit identification and in all standard sizes for use up to 5,000 volts.

3339

OKONITE

OKONITE Insulated Wires and Cables

Electroline FIEGE

HEAVY-DUTY COUPLING

FOR SPLICING COPPER STRAND (300 to 1000 MCM)

Gives you these Big ADVANTAGES

1 ***HIGH PRESSURE*** — Metal to metal contact under high pressure gives ultimate electrical and mechanical strength.

2 ***HIGH CONDUCTIVITY*** — Its resistance is less than an equivalent length of the conductor itself.

3 ***STRONGEST*** TYPE OF COUPLING when used with steel, copper or composite strands.

4 ***NO WASTE*** of conductor, in fact the coupling itself can be used over and over again. Easily disconnected . . . free from corrosion.

5 ***SOLDERLESS*** — No hot metal is needed. No special tools required. Common tools make or unmake the connection.

6 ***EASY INSPECTION*** — Inspection holes make visual inspection of the joint quick and positive. No guess work. A sound connection is certain.

SIMPLE TO INSTALL

ONLY THREE SIMPLE OPERATIONS ON EACH END— THEN THE COMPLETE JOINT

Electroline Company

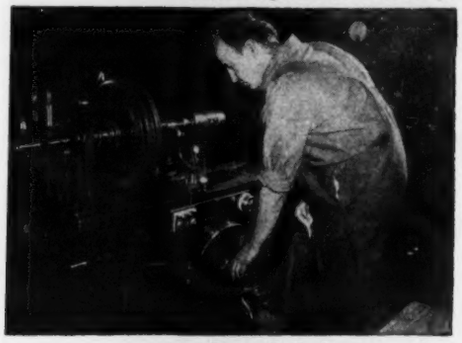
Originators and Patentees of Automatic Line Splices and Dead Ends

4121 South La Salle Street Chicago, Illinois

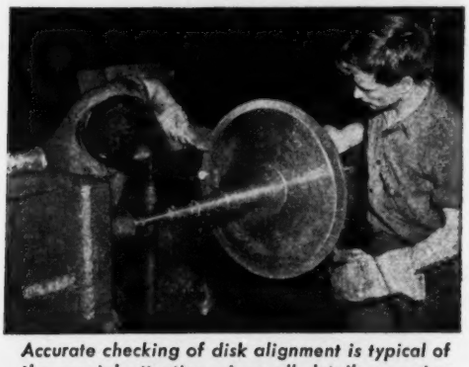
Available in complete range of sizes from 300 MCM to 1000 MCM in straight couplings as illustrated. Also made in dead end types. *Write today for complete prices and illustrated literature.*

They take war service in stride

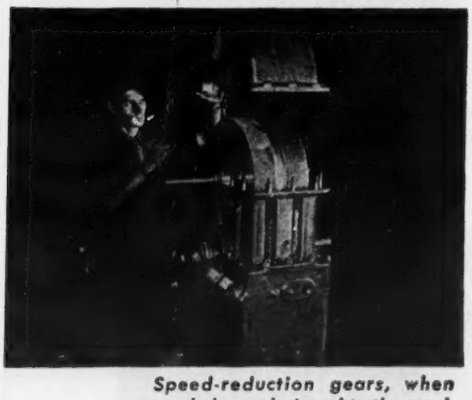
Accurate reaming of nozzles insures high turbine efficiency.



Dynamic balancing makes a smooth-running turbine.

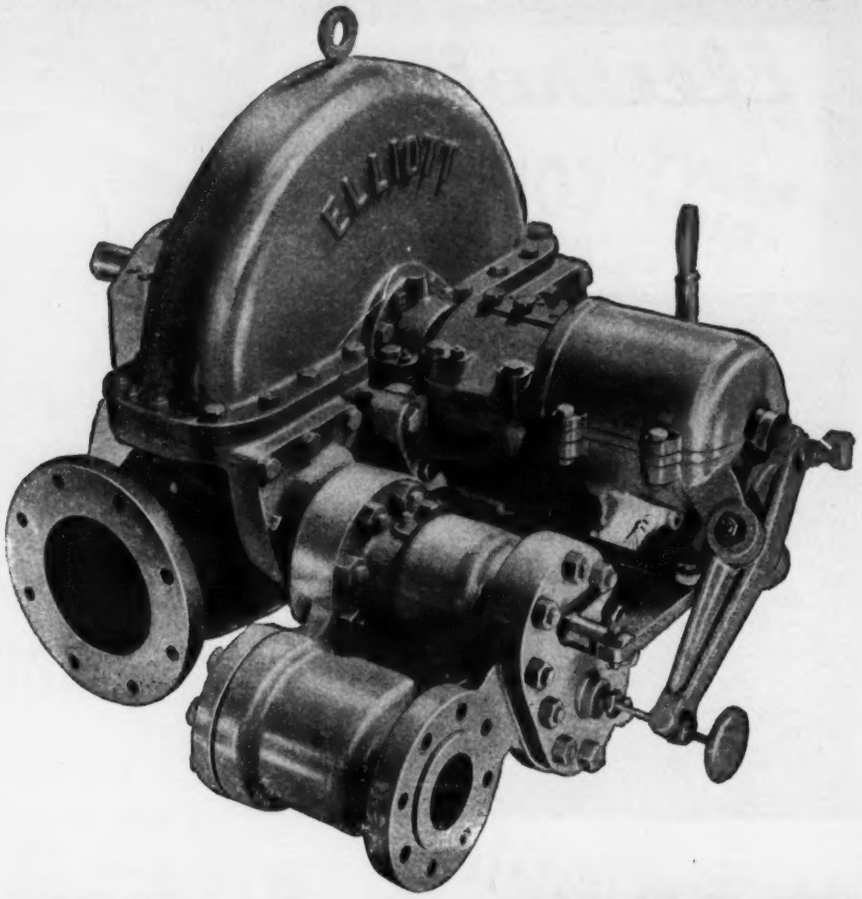


Accurate checking of disk alignment is typical of the special attention given all details, assuring continued "top" performance and reliability.



Speed-reduction gears, when needed, are designed to the need.

The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.



ELLIOTT

Mechanical Drive TURBINES

Elliott men always did take pride in building good turbines.

Today, they take further pride in the job the turbines are doing in driving pumps, fans, blowers, and generators in all sorts of war plants — and the plants which power the industries straining to produce the things so urgently needed to implement our fighting forces.

In a war world, Elliott turbines are maintaining their reputation as reliable, sturdy machines, just the kind needed for 24-hour-a-day service from now on.

All you have to do is to give them the benefit of inspection and intelligent operation and keep 'em turning.

•

All required sizes, for steam conditions up to 600 lb. gage, and 750 deg. F. Single stage and multi-stage types. Gears, built-in or separate, when required.

ELLIOTT COMPANY

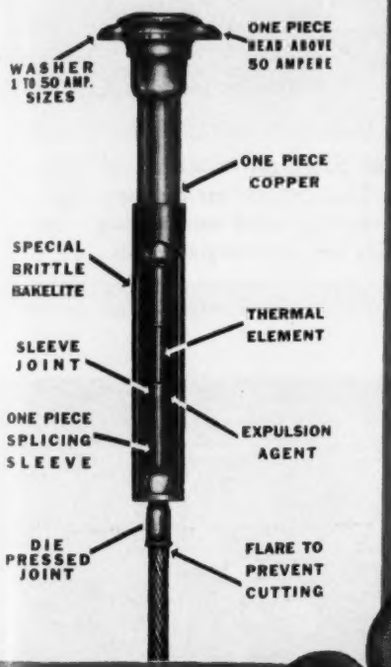
Steam Turbine Dept., JEANNETTE, PA.

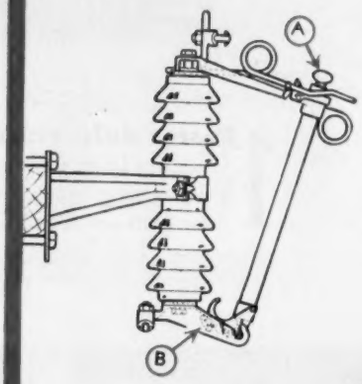
DISTRICT OFFICES IN PRINCIPAL CITIES

H-669

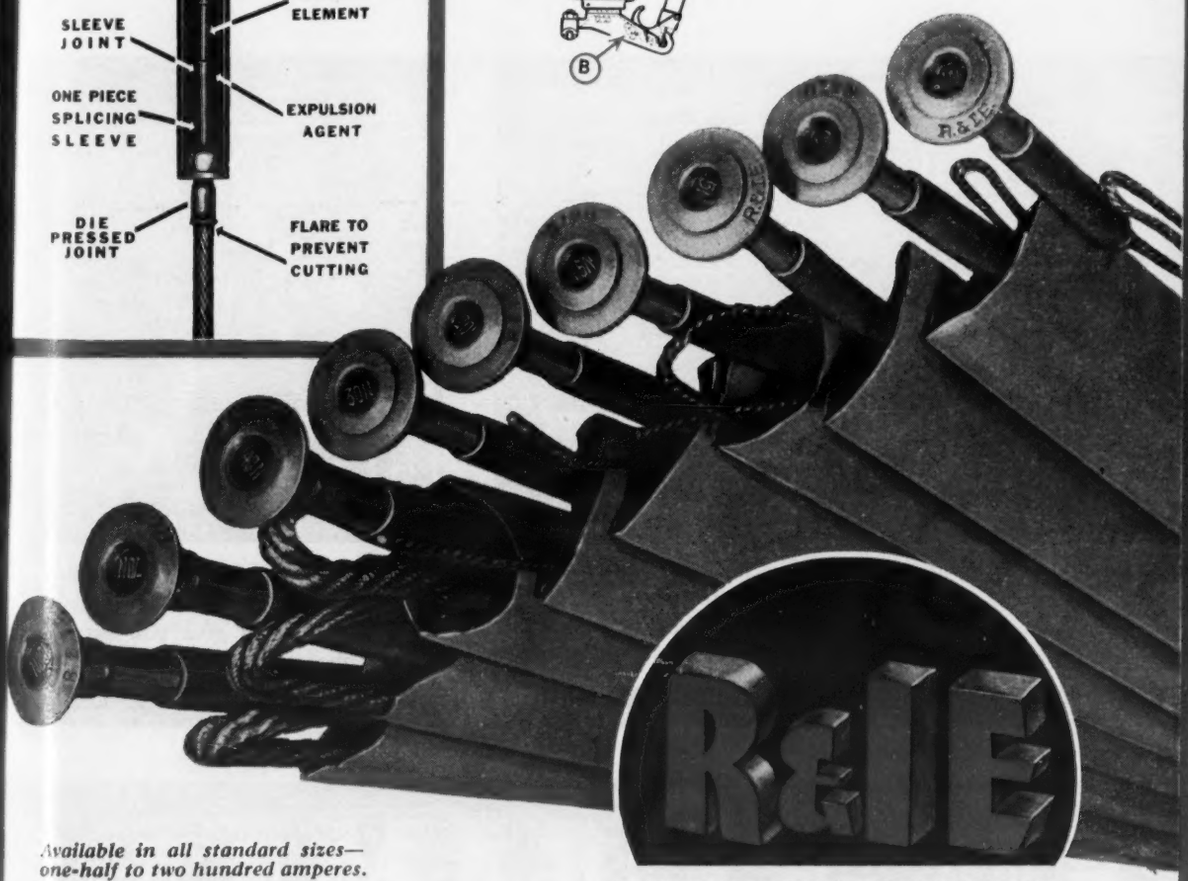
CHECK the FACTS

1. Universal interrupting link—fits any type cutout.
2. An accurate interrupting link—range of operation to within 90 to 110% of time current curve.
3. Positive expulsion—not dependent on arcing.
4. No fusing element—no partly melted links.
5. Repeated overloads do not reduce rating.
6. High mechanical strength.





APPLICATION—Showing R&IE type KOT dropout cutout. In service, thermo-rupter head is covered by cap screw "A". End of lead wire is clamped by thumb-screw "B" which holds tube in place until link is expelled.



Available in all standard sizes—one-half to two hundred amperes.

R&IE

THERMO-RUPTER

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

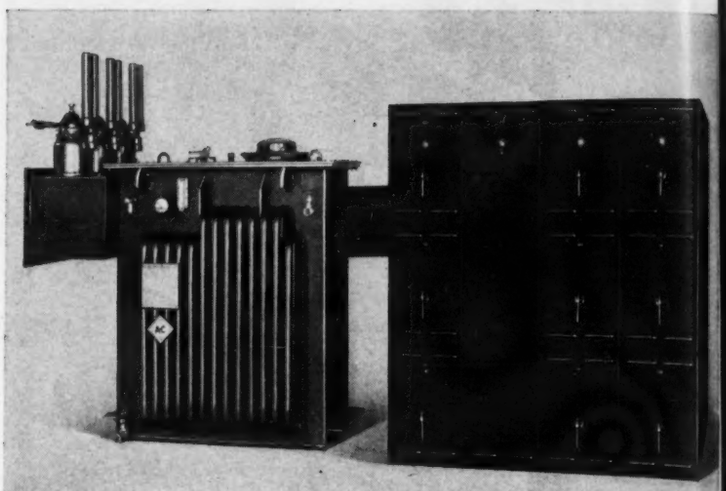
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

The Check list

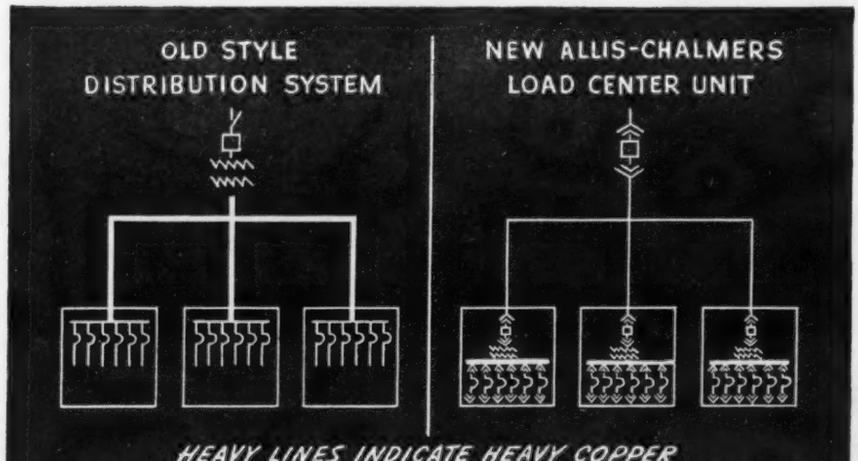
- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

Here's the Plus

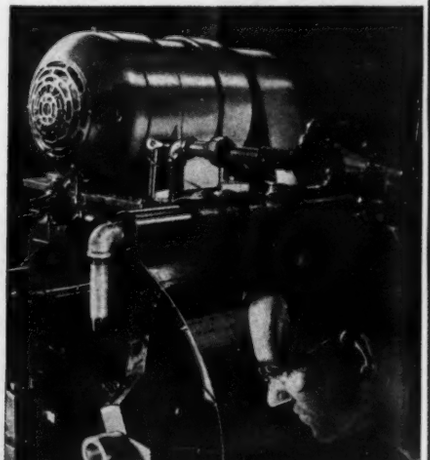
Modern packaged design of great new Allis-Chalmers Standard Load Center Unit Substations gives you 6 important new wartime *and peacetime* advantages!



1 ***Faster deliveries!*** Standardized design of Allis-Chalmers Load Center Unit Substations eliminates "specials," saving time on drafting board and in shops. Yet these units are completely adaptable to your needs . . .



4 ***Big copper savings!*** Installed right at machines they serve, Load Center Unit Substations reduce length of heavy secondaries. You save money for your company, precious copper for the U. S. And Chlorextol-liquid-filled or dry type transformers need no vaults!



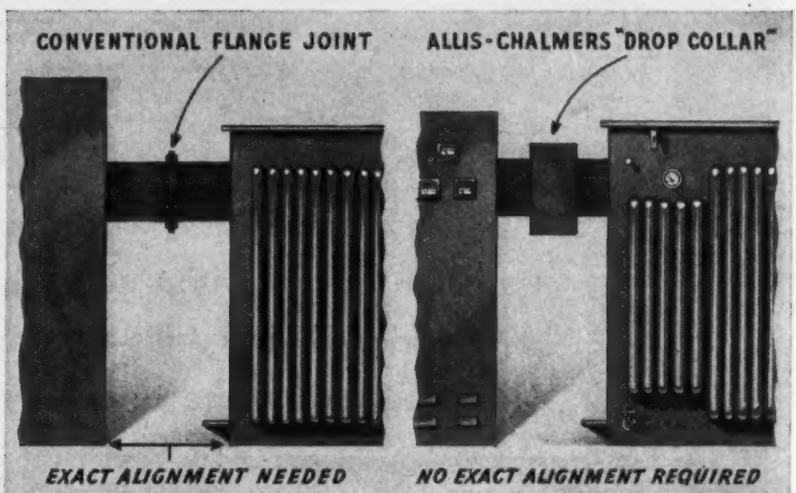
5 ***Better performance!*** Lower losses and improved regulation give you better motor and lamp performance.

ALLIS-CHALMERS

sin Packaging!

HIGH SIDE	LOW SIDE
1. DISCONNECT SWITCHES	1. STATIONARY AIR BREAKERS
2. OIL FUSE CUTOUTS	2. DRAWOUT AIR BREAKERS
3. METAL-CLAD SWITCHGEAR	(CAN BE ELECTRICALLY OR MANUALLY OPERATED)
4. DIRECT CONNECTION TO ROOF BUSHINGS	
5. THROAT CONNECTION TO BUS RUN	

2 ***Flexibility!*** Note wide variety of high and low voltage equipment. Transformers are oil or Chlorextol-liquid-filled or dry type.



3 ***Easier installation!*** Allis-Chalmers "drop collar" on outdoor units and on high side of indoor units means no flanges to bolt, no need for exact alignment at base. Flexible cable low-voltage connection on indoor units also saves time.

6 ***Saving in space!*** Compactly designed, an Allis-Chalmers outdoor Unit Substation fits into the *corner* of a conventional substation! If load center shifts, these packaged units are easier to move. And that trim *appearance* is an asset!

It All Adds Up to Smart Buying!

WHEN YOU specify Allis-Chalmers Standard Load Center Unit Substations, you specify faster deliveries, great flexibility, big savings for your company in both installation time and space!

That's smart buying—and patriotic buying, too. These new units help you contribute important copper saving to the war effort!

Get the *full* story on Load Center Unit Substations from the district office near you. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1587

UNIT SUBSTATIONS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

O.K. for U.S.A.!

"Will it help win the war?" is the first question asked when new equipment is considered. For Allis-Chalmers 5/8% Step Regulators the answer is "Yes!"

NO one can afford faltering voltage today—your country, your customers, or *you!*

There are two ways you can boost it:

First, by rebuilding feeders or installing new ones — costly in copper and time.

Second, by using a regulator instead — *saving thousands of pounds of copper plus precious man hours!*

Remember, engineers today have important reasons for specifying Allis-Chalmers 5/8% Step Regulators . . .

1. Closer Regulation — 5/8% half-cycling steps plus "Feather-Touch Control" permit band width settings within ± 5/8%.

2. Longer Contact Life — Not a single contact has ever been replaced due to deterioration in normal operation!

3. Lower Exciting Current — Need only 1/3 the exciting kva required by older regulators.

4. Minimum Maintenance — No holding or braking devices. All moving parts immersed in oil.

For the full story, call your nearby district office. ALLIS-CHALMERS, MILWAUKEE, WIS.

A 1579

ALLIS-CHALMERS 5/8% STEP REGULATORS

On the O-B laboratory roof, flanked by two main-line railroads and surrounded by smoke-belching factory chimneys, samples of O-B malleable iron are given long-time exposure to highly corrosive atmosphere. Pieces of various vintages are represented; dating back 18 yrs.

O-B malleable iron unaffected after 18 years of exposure!

Prolonged atmospheric exposure takes no toll of O-B malleable iron transmission line hardware. This metal has a valuable and unique resistance to attack from the elements. Like all ferrous metals it quickly rusts but, *unlike* other ferrous metals this rust coat remains permanently bonded to the base metal and cannot flake away; exposing fresh metal and gradually "dissolving" in the air. Once the rust coat forms on malleable iron, the metal is provided with an effective natural protection against further attack... Sooner or later, the thick coat of hot-dip galvanizing may disappear but Nature will take over when this time comes and no damage will occur to O-B hardware. Original cross-sections of metal will remain intact. Strength will be un-affected. Service life will be indefinitely long... This is only one reason why O-B casts transmission hardware in malleable iron, but it is *one good reason*, and an equally good one why your hardware should be O-B.

2423-H

FOR VICTORY
BUY UNITED STATES WAR BONDS AND STAMPS

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Company, Ltd., Niagara Falls, Ontario

Power for the production front!

WELDING has probably contributed more to the improvement and speeding up of war production than any other single process. It saves time and money. It is a potent production weapon that women have learned to use as skillfully as men.

Here, again, electricity plays a vital role. Unfailing electric power must feed these modern tools. And unfailing power requires unfailing transmission and distribution—a job that can be entrusted only to electrical wires and cables of the finest quality.

For years, American Steel & Wire Company engineers and production experts have experimented with new methods and new materials to improve the quality of our electrical wires and cables. The war proved the soundness of this policy, for the sudden scarcity of certain critical materials did not catch us napping. New materials were available to help the conservation program without sacrifice of quality or performance. Our products were ready when the emergency came; and they'll be ready when peace comes.

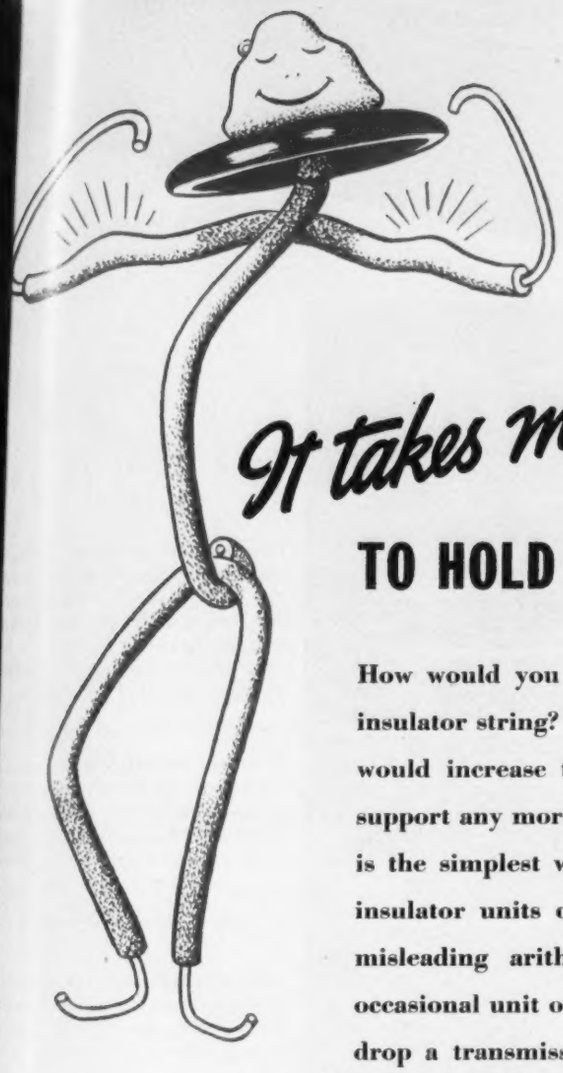
For our research goes steadily on—working on new ideas and developments to take care of the increased wartime demand for power and light and the ultimate conversion to peacetime requirements.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

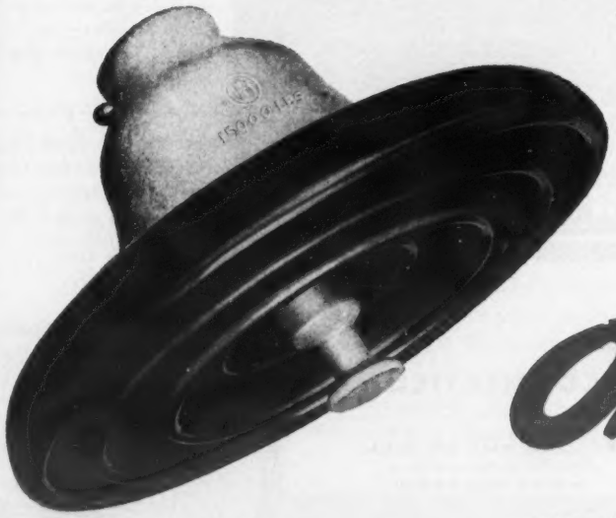


It takes more than Arithmetic

TO HOLD UP A TRANSMISSION LINE!

How would you increase the working strength of a suspension insulator string? Would you add one or two stronger units? This would increase the *average* strength of the string, but would it support any more weight than before? You *know* it wouldn't!...This is the simplest way of telling why O-B *does not* rate suspension insulator units on the basis of average strength--it's a piece of misleading arithmetic, because average strength includes the occasional unit on the extreme low end of the average that might drop a transmission line...On the cap of every O-B suspension insulator is permanently branded the minimum strength value of the insulator. Most will exceed it. Naturally there are strength variations in O-B insulators but they all occur *above* the rated figure, not to some indeterminate degree on both sides of it...This assurance of definite strength limits costs you no more. Specify O-B suspension insulators and get the kind of strength rating that really counts, because you can *count* on it!

2402-H

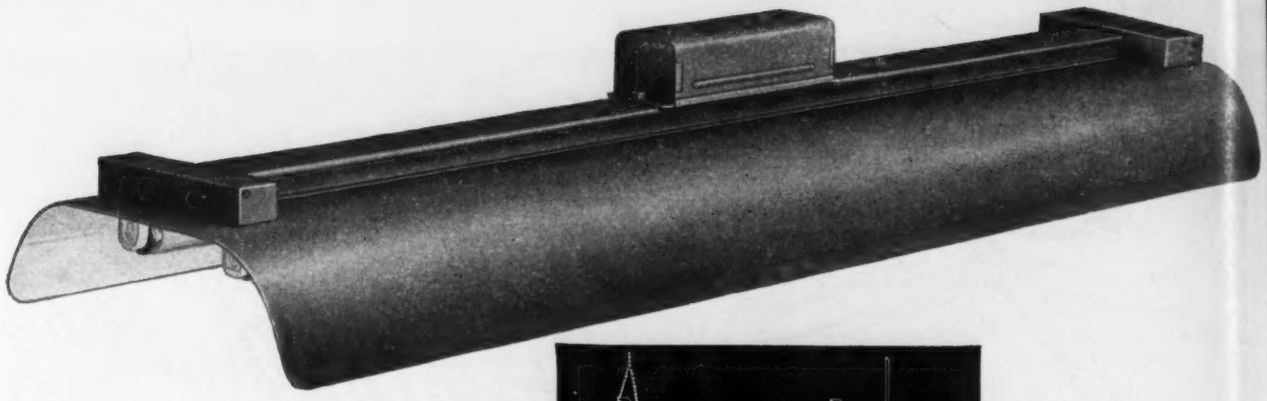


Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONTARIO

★ ★ ★ KEEP BUYING WAR BONDS ★ ★ ★



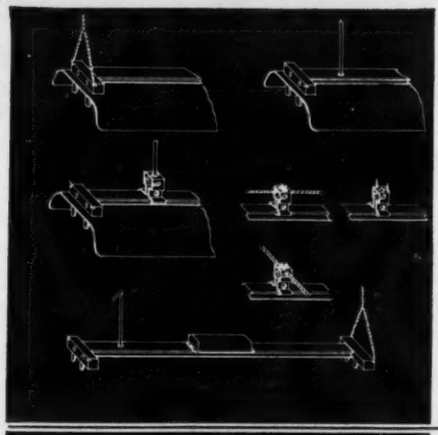
MILLER does it again...with

AERO-DESIGNED

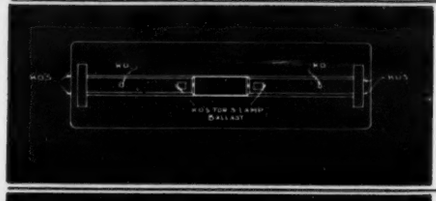
FLUORESCENT LIGHTING!

AERO-DESIGNED fluorescent lighting is MILLER'S answer to recent WPB regulations limiting the total amount of steel in fluorescent fixtures. To war plants, badly in need of more modern, productive lighting, it means in effect MILLER 50 FOOT CANDLER and 100 FOOT CANDLER fluorescent lighting systems are still available *without any sacrifice* of lighting efficiency, economy of installation, ease of maintenance, mobility or rugged construction.

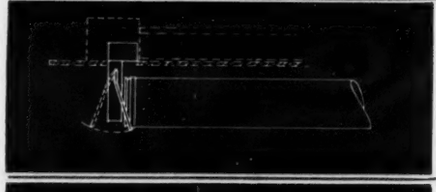
Read carefully, please, the principal features of this new *AERO-DESIGNED* lighting as listed at the right. Then sit down and write MILLER at Meriden for full information . . . or call in our nearest field engineer (located in principal cities) for a specific discussion of how you can use this modern lighting to help busy war plants.



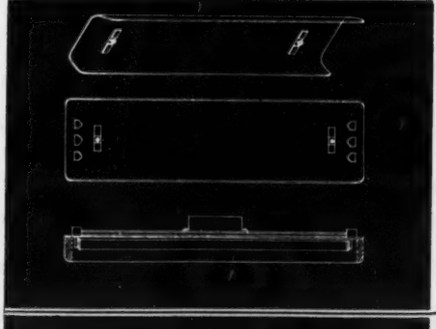
FLANGED TOP *of channel permits clamp strap attachment at various points along channel, for ceiling, rod or cable mounting to suit any ceiling structure. Also can be suspended with chains, conduit or combinations of these methods.*



WIRING CHANNELS, *now streamlined, contain all necessary wiring and auxiliaries—with ballasts exposed for heat dissipation. Can be used as individual lighting units or in continuous rows.*



MILLER SAFETY SOCKETS *with integral safety lock to prevent lamps from falling are rigidly spaced and substantially mounted.*



REFLECTORS *are of Masonite with durable IVANITE, the "sealed-in-surface" finish for high reflection factor. Lightweight, easy to remove, simple to clean. Reflectors are "extra length" for good shielding of lamp ends. Miller reinforcing reflector attachment strap assembly is an integral part of each reflector—no change required for either two or three-light units.*

FIXTURES *carry both Underwriters' and RLM Standards labels—are backed by written warranty and MILLER'S almost 100 years of lighting experience.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Prepare them for 3 Shifts!

WHEN YOU CHANGED from one shift to three, you began crowding *3 years of wear* into one calendar year of operation!

You've got to *condition* your machines for full-time operation. You can't expect them to stand the gaff with "good enough" lubricants.

On such important production units as geared motors make sure you are using a Gargoyle Vacuoline Oil.

This member of the famous Gargoyle "family" has the chemical stability to stand up under "round-the-clock" operation. This means... freedom from emulsions and sludge... long oil life... and long, trouble-free gear life, too!

In fact, Gargoyle Vacuoline Oil is ideal for enclosed circulation-oiled and splash-oiled gears. Forty-eight hours a week—or 168 hours—this oil will provide dependable lubrication.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

CALL IN SOCONY-VACUUM

THE MAGNAFLUX CORPORATION ANNOUNCES A

new service

● The power field has known Magnaflux Corporation as the *company* behind a *method.* Now it is time to enlarge that idea. The Magnaflux Corporation, originator of three inspection methods, and manufacturer of equipment, is also a service organization.

The method of magnetic indications (Magnaflux) was readily accepted from the start as having strong possibilities in equipment overhaul inspection. Among operators who investigated those possibilities, striking results were achieved. Prevention of shutdowns plus prolonged periods of service and reduced costs created a desire for regular consistent service—MAGNAFLUX POWER PLANT INSPECTION SERVICE.

In announcing this Magnaflux Service it is remarkable that two additional methods which greatly increase its scope are now fully developed and included—teamed up with the Magnaflux Method for all 'round flaw detection! Prospective savings to Industry run far into the millions.

The Basic Technique: Magnaflux

The basis of the Magnaflux Method is to set up a magnetic field in parts under inspection. Leakage fields attract and hold finely divided ferro-magnetic particles in patterns which locate discontinuities. Naturally this was restricted to magnetic metals. Even so, the time saved in shortening overhaul periods was a big economy. A Magnaflux turbine inspection engineer inspects about 20,000 KVA of blading per day in assembled spindles (under normal conditions). Only the upper half of the housing need be removed. Cracked blading, incipient cracking in turbine discs, both radial and the circumferential type which occurs between balance holes, can be found. Inspection of a turbine requires less than one-third of the time of visual and magnifying glass methods, and is infinitely superior in accuracy.

Magnaflux, Plus Magnaglo

To this service, there is now added, through development by Magnaflux Corporation's research staff, all the possibilities of the Magnaglo Method. For surfaces on which the ferro-magnetic indication cannot be clearly observed, either through texture, color or lack of light, Magnaglo provides a speedier more sensitive method. It yields the same type of indications seen in correctly magnetized parts of steel and its magnetic alloys. The same distribution of ferro-magnetic particles is made—with this refinement: *The particles are also fluorescent and glow brilliantly in darkness under black light.*

Plus Zyglo for "Non-Magnetics"

It is only a step from this development to the most amazing increase in the scope of Magnaflux Service. The Zyglo method permits *similar inspections of the non-magnetic metals.* The complete service job now opens up the great majority of all plant equipment to the economy, safety and conservation of *preventive inspection.* Aluminum, brass, stainless steel and bronze practically double previous possibilities.

Zyglo, by successive applications of a penetrant fluroscent liquid, a rinse, and a developing powder, reveals discontinuities which can be clearly interpreted under black light in darkness.

Three Methods Combined

A three-way advance in technique therefore enables Magnaflux Corporation to offer a fully rounded service for the power field. On notification of an expected overhaul a service engineer's time can be scheduled for a plant, and a more thorough check than ever was possible before can be made of all primary equipment for indications of fatigue, embrittlement, distortion. Like specialized

Detection at These Typical Failure Points

- Fatigue Cracks
  - in Turbine Blading
  - in Engine Shafts
  - in Turbine Disc Wheels
  - in Crank Webs
- Progressive Fractures
- Lap Seam Cracks
- Caustic Embrittlement in Boiler Plate
- Cracked Frames
- Vibration Effects on Piping Threads
- Inter-granular Cracking of Boiler Drums
- Flywheel Spoke Fractures
- Overheated Boiler Shells
- Defective Welds
- Overstressed Pipe Bends
- Overstressed Chains, Grapples and Chains and Crane Hooks
- Valve Body Failure from Piping Expansion
- Turbine Blade Damage from Adjacent Breaks

MAGNAFLUX CORPORATION

MAGNAFLUX CORPORATION

o Foresee and Prevent Mechanical Failure In Power Plant Equipment

ols, each of the Magnaflux Corporation's chniques can be used where it is most itable.

Service Organization

Through Magnaflux Corporation's anches and field representatives, a ser- ice contract can be made for periodic in- pections at a rate based on horsepower and ypes of equipment. Scheduling of service coincide with tear-down and overhaul work can be arranged. This division of the Magnaflux Corporation is organized to make a limited number of such contracts at once. Further expansion of the service will follow as the manpower situation permits.

A Limited Number of Plants Can Be Served As An Initial Group.

•

Write for Complete Details

All interested companies are urged to write for the fullest details of the service now. Its benefits will be extended in their territory as rapidly as possible, after a picture of the demand is secured.

Northwest Highway, CHICAGO • New York • Detroit • Los Angeles • Dallas

QUALITY.. SERVICE..... PERFORMANCE..

Conservation restrictions controlling the use of copper, rubber and other scarce materials affect production of all Simplex wires and cables. Today we cannot put some of the desirable ingredients into our insulation as freely as we could only a short time ago but our study of their use in cable insulation and our records of their effect on cable performance enable us to get the best possible results with the limited quantities that we are now permitted to have.

The serviceability of Simplex wires and cables has been maintained at a high level but priority regulations restrict their manufacture to orders for essential war work. Production of wires and cables for commercial use has been almost entirely eliminated. Cables can be bought only for service having high priority rating.

If you must have new cables for such work it will be well worth-while to bear in mind that Simplex trade names have stood for quality, service and performance for over half a century. They still represent a product based on years of experience and, although modified in some respects to meet war conditions, they still assure satisfactory performance.

Simplex

WIRES AND CABLES

ANHYDREX Submarine cables insulated with deproteinized non-water absorptive rubber.

ANHYDREX* Underground cable that needs no steel tapes, lead sheaths or other protection.

CAOUTCHOUC* (B. C.)—a rubber covered braided building wire with 30% rubber insulation.

CONDEX cable protected with overlapping, interlocking flexible steel conduit.

FIBREX* Tree Wire for power line installation among trees or where chafing of the line may occur.

LATOX* cables insulated with the new rubber insulation made directly from prevulcanized latex.

LATOX* cords with rubber insulation on the conductors and with a sheath made from prevulcanized latex.

PLASTEX wires and cables with flameproof, ozoneproof, acid, oil and alkali-proof, low voltage insulation.

SIMCORE — a building wire that meets the Underwriters' Laboratories requirements.

SIMPLEX Power cables with varnished cambric or impregnated paper insulation.

TELEX Underground Telephone Wire that is laid without conduit.

TIREX rubber jacketed cables for portable machines where rough service is imposed on the cables.

TIREX rubber jacketed cords for portable electrical tools and appliances.

*Discontinued for the duration of the war.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

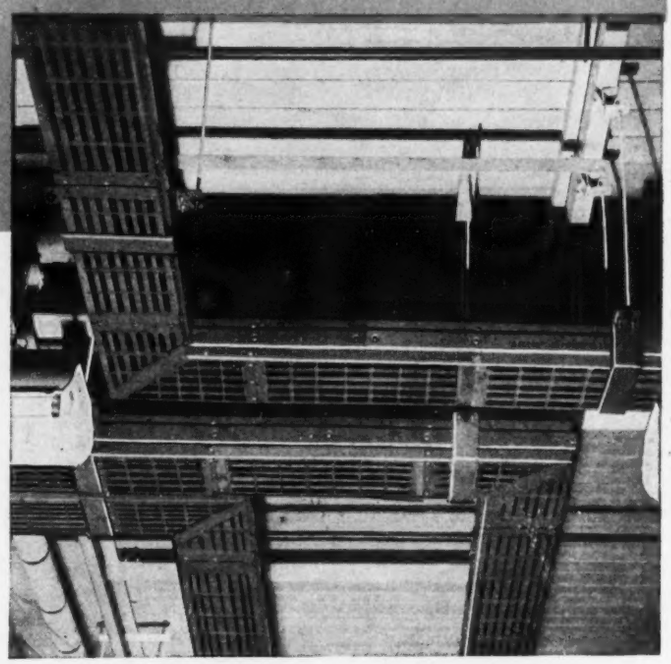
ARMY E NAVY

Simplex WIRES and CABLES

TRUMBULL design . . . NEW W.P.B. ratings

L.V.D. system and FLEX-A-POWER

conform to limitation order L-273



- **EFFECT IMPORTANT STEEL AND COPPER SAVINGS**
- **CAN BE USED WITH TRUMBULL SYSTEMS ALREADY INSTALLED**
- **ASSURE COMPLETE MECHANICAL AND ELECTRICAL PROTECTION**
- **SIMPLIFY INSTALLATION ENGINEERING**

L. V. D. **The Trumbull "Airated" L.V.D. (LOW VOLTAGE DROP) Feeder System** was the first thoroughly engineered approach to the problem of main electric power feeder distribution in industrial plants effecting MAXIMUM ECONOMY in use of copper and steel for a given load capacity, and at the same time showing EXTREMELY LOW VOLTAGE DROP.

This system is now available, embodying tried and proved Trumbull design features and in conformance with W.P.B. Limitation Order L-273, in the following range of current ratings: 250, 400, 600, 800, 1000, 1350, 1600 and 2000 amp. Efficiently ventilated metal protective enclosures completely house and protect bus bars that are individually encased in high-temperature resisting CARBONOT sheathes. The entire structure is rigidly braced against electrical and mechanical stress with short circuit ratings 100,000 R.M.S. amperes and over. Improved Vystipe bus bar connectors and silver plated joints.

Here is your answer to urgently needed power capacity expansion . . . assuring *full voltage at point of load, maximum economy* in use of vital materials . . . electrical and mechanical safety . . . flexibility and full salvability to meet future changing needs.

FLEX-A-POWER Without departing from Trumbull design standards for electrical efficiency, safety and performance, **FLEX-A-POWER Plug-in Systems and FLEX-A-PLUGS** now conform to W.P.B. Limitation Order L-273. New standardized current *ratings are 250, 400 and 600 amp.*, with the smaller size 125 amp. FLEX-A-POWER and Plugs redesigned to rate 250 amp. without change in dimensions.

Note especially that, while cooperating to the fullest extent in conservation of vital materials and simplification of ratings, FLEX-A-POWER maintains the high Trumbull standards for quality of construction, carefully engineered electrical and mechanical design and unlimited flexibility in application. Bus bars are still completely enclosed in strong steel housings . . . fully protected electrically and mechanically. **Bus bar sections and plugs are interchangeable with Flex-A-Power equipment already installed.**

◆

Trumbull Engineers are fully conversant with the requirements of Limitation Order No. L-273. They will be glad to help you in the planning and installation of L.V.D. or Flex-A-Power System in conformance with its terms.

TRUMBULL

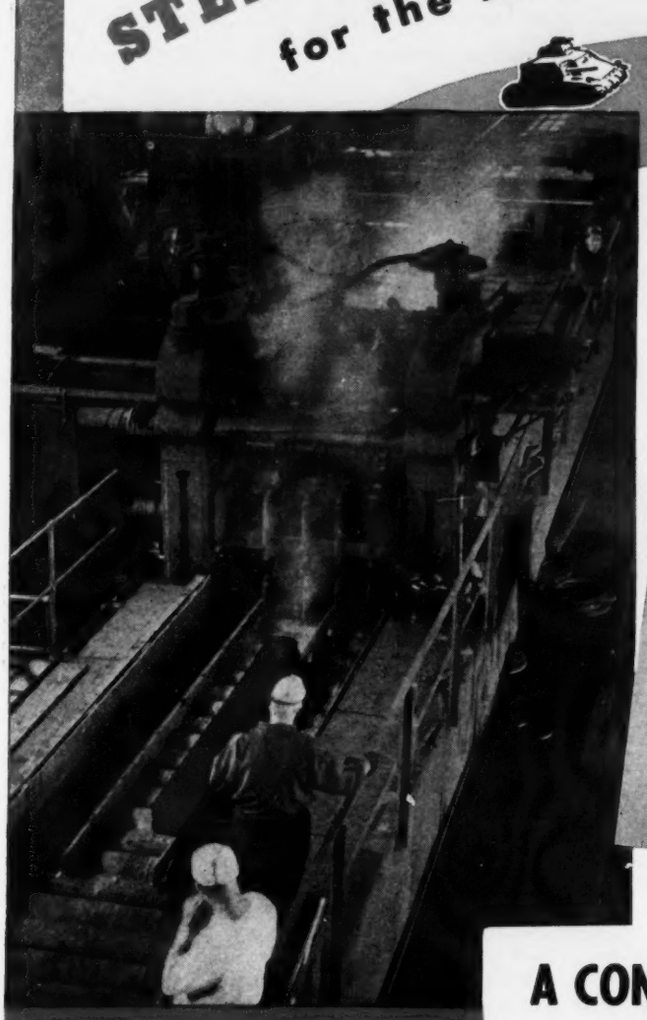
ENCLOSED BUS BAR SYSTEMS

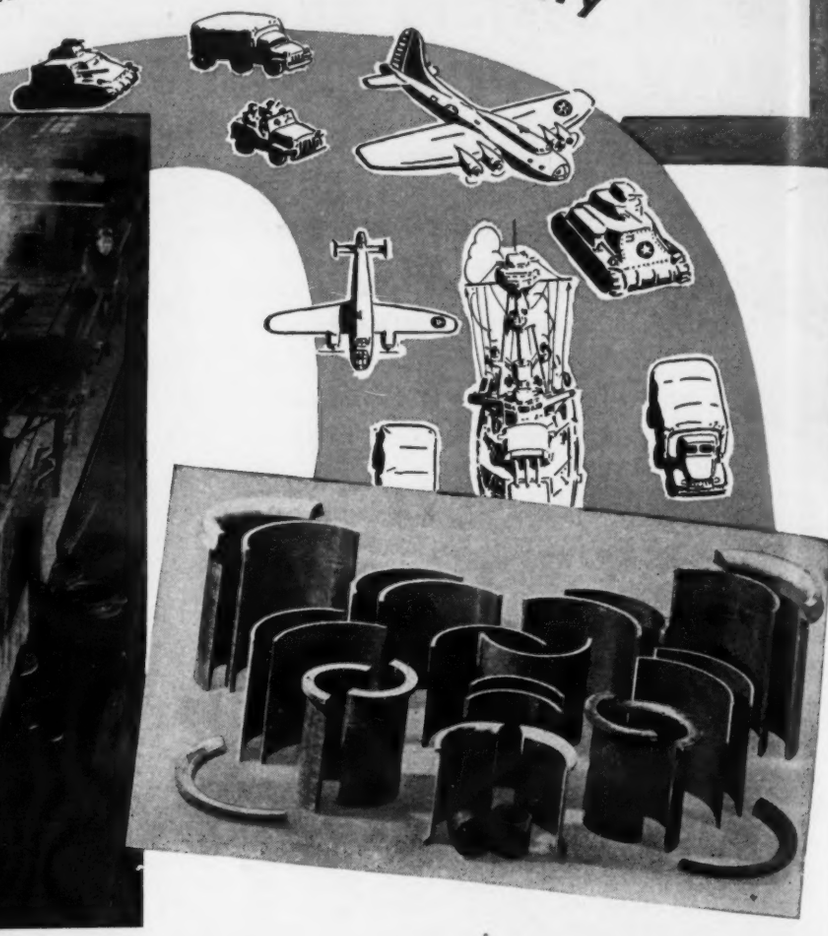
THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

STEEL..STEEL..STEEL!

for the hungry jaws of industry





LAMINATED

Plastic

NON-METALLIC

BEARINGS

A CONTINENTAL-DIAMOND PRODUCT—

speeds wartime steel production

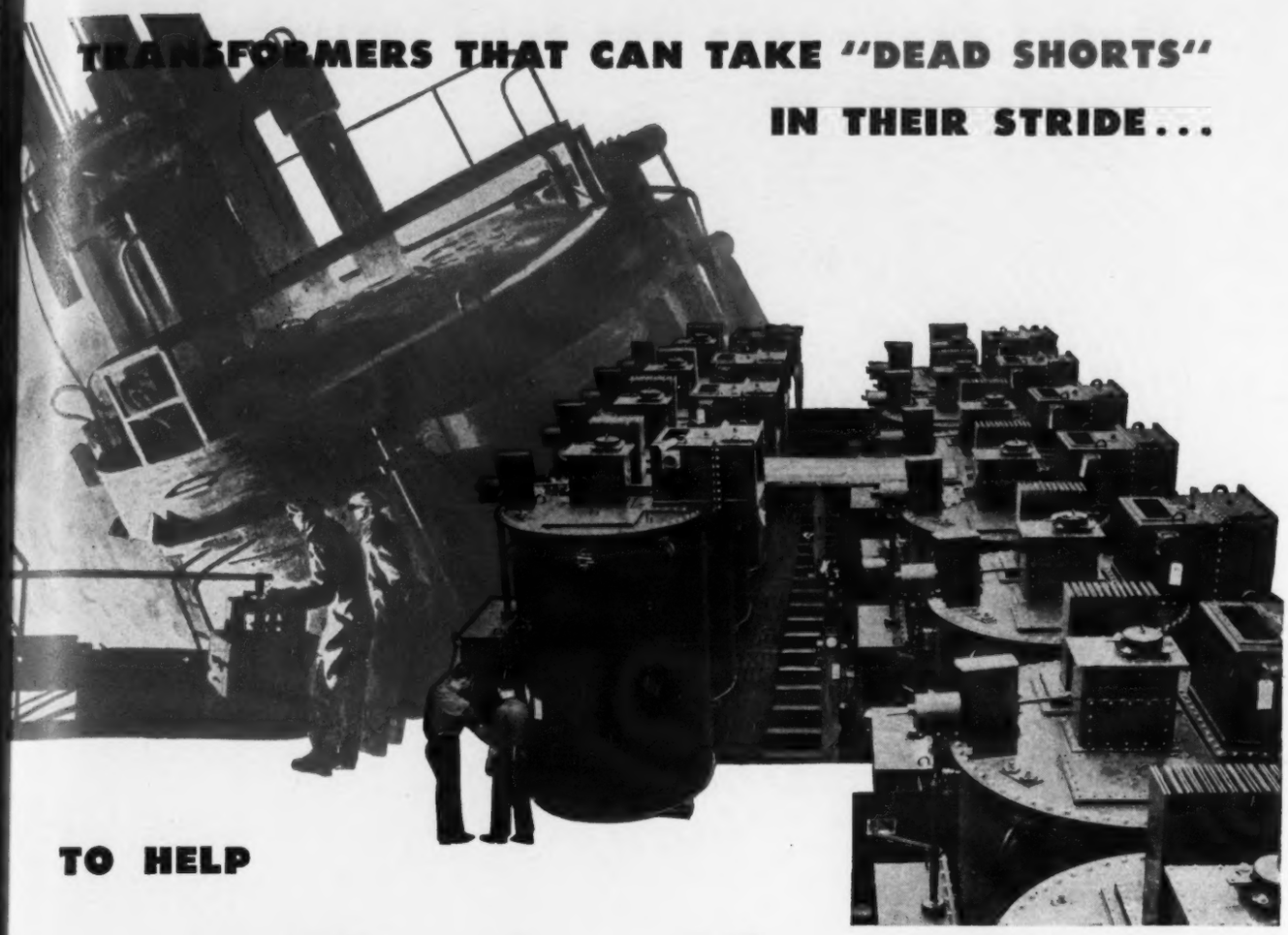
Steel rolling mills are making longer runs, holding closer tolerances, producing more vitally needed STEEL because of Plastic NON-metallic roll neck bearings. A C-D product, first applied experimentally in 1933, these NON-metallic bearings are now giving unprecedented service in steel mills everywhere, making an immeasurable contribution to the war effort by helping produce more and better steel.

The same research and engineering staff that developed and perfected C-D Plastic bearings is ready to help you with your "What Material?" problems. Men familiar with five basic NON-metallic products, laminated phenolic plastics . . . molded phenolic plastics . . . vulcanized fibre . . . Mica . . . Vulcoid, can help you determine where they can be used in your plant or product . . . to further the War effort . . . to prepare to meet the Peace. Send for booklet GF-3 which gives specific data on all C-D products.

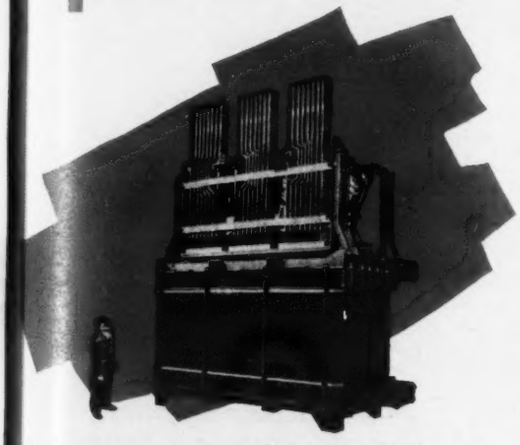
Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

TRANSFORMERS THAT CAN TAKE "DEAD SHORTS" IN THEIR STRIDE...



TO HELP "pour the heat" ON THE AXIS!



SHELL-FORM WINDING FOR LARGEST SINGLE TRANSFORMER EVER BUILT

For mechanical strength to withstand repeated shock of short-circuit currents, the shell-form furnace transformer has no equal. Steel almost completely surrounds and rigidly supports coils, preventing movement of windings.

Twenty-four hours a day, America's electric furnaces are melting and pouring "heats" of tough alloys to make guns, shells and armor.

Twenty-four hours a day, the transformers that supply the electric power for these furnaces must stand the twisting, distorting stresses of repeated "dead short" conditions.

The 11 Westinghouse shell-form furnace transformers shown above (one of the largest orders ever delivered) are but a few of the many Westinghouse transformers helping to "pour the heat" on the Axis.

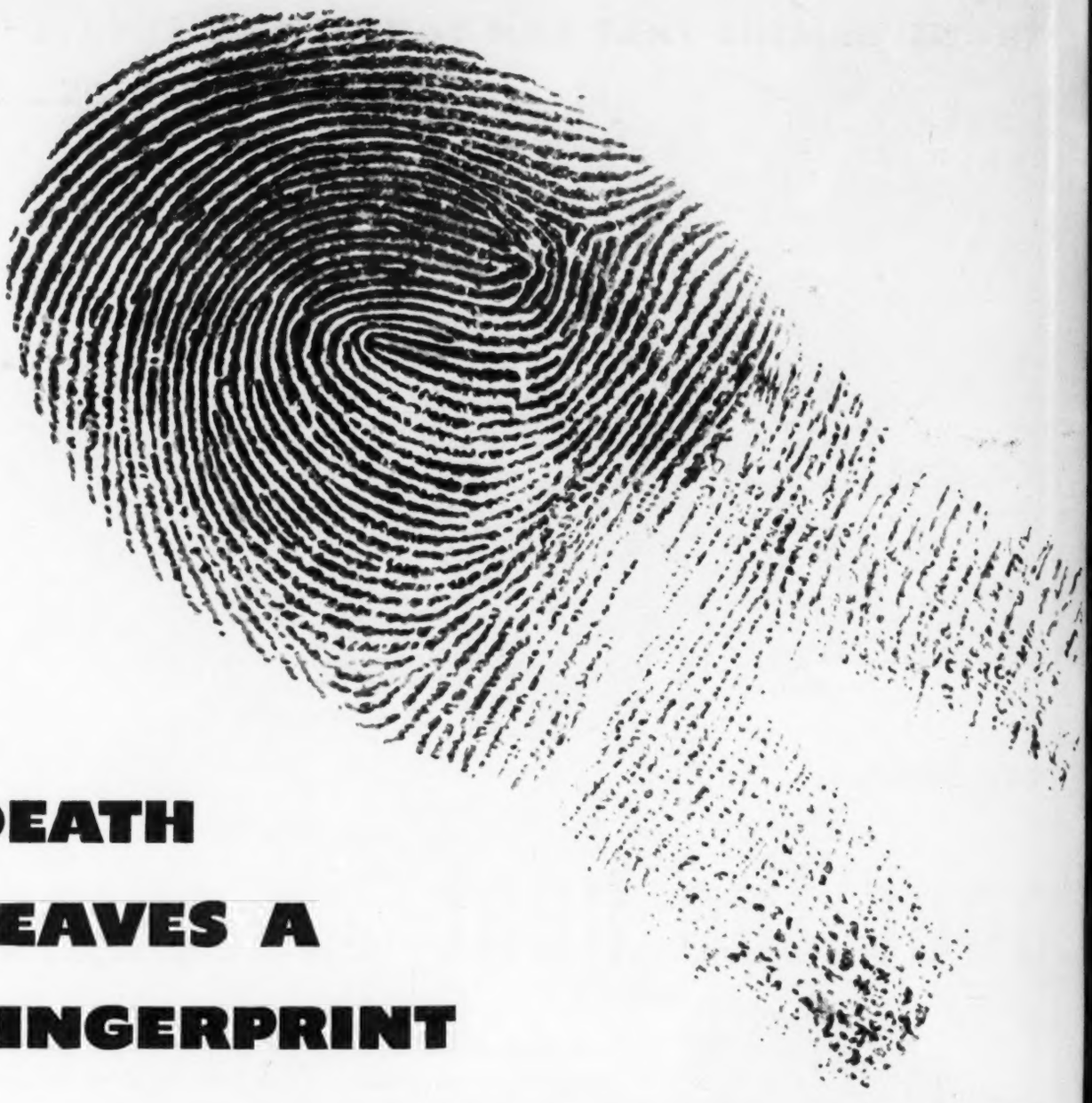
Flexibility of design—plus 56 years of experience—insures getting the right transformer . . . *either shell-form or core-form* . . . for the job. Investigate today—call Westinghouse. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-70397

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

POWER TRANSFORMERS



DEATH LEAVES A FINGERPRINT

Probably it was hot and humid in the assembly room... that day when warm, perspiring fingers accidentally touched a tiny, needle-pointed shaft. But the fingerprint remained... acid, corrosive...

A saboteur—this accidental fingerprint? Yes—for on a later day that tiny part, weakened by corrosion, may fail—in a submarine depth-gauge, an airplane altimeter, or in any of scores of delicate military instruments. And just because of a fingerprint, a man may die.

* * *

ANOTHER WAR JOB FOR AIR CONDITIONING. Where precision instruments are made, on which men's lives depend, air conditioning reduces perspiration . . . filters out dust . . . helps speed output.

And this is but one example of how General Electric *air conditioning* and *industrial refrigeration* may serve the war effort. To meet the exacting requirements of these wartime applications, General Electric is producing equipment that is highly efficient . . . flexible . . . compact.

When peace comes, this improved air conditioning equipment — by General Electric—will be available to all.

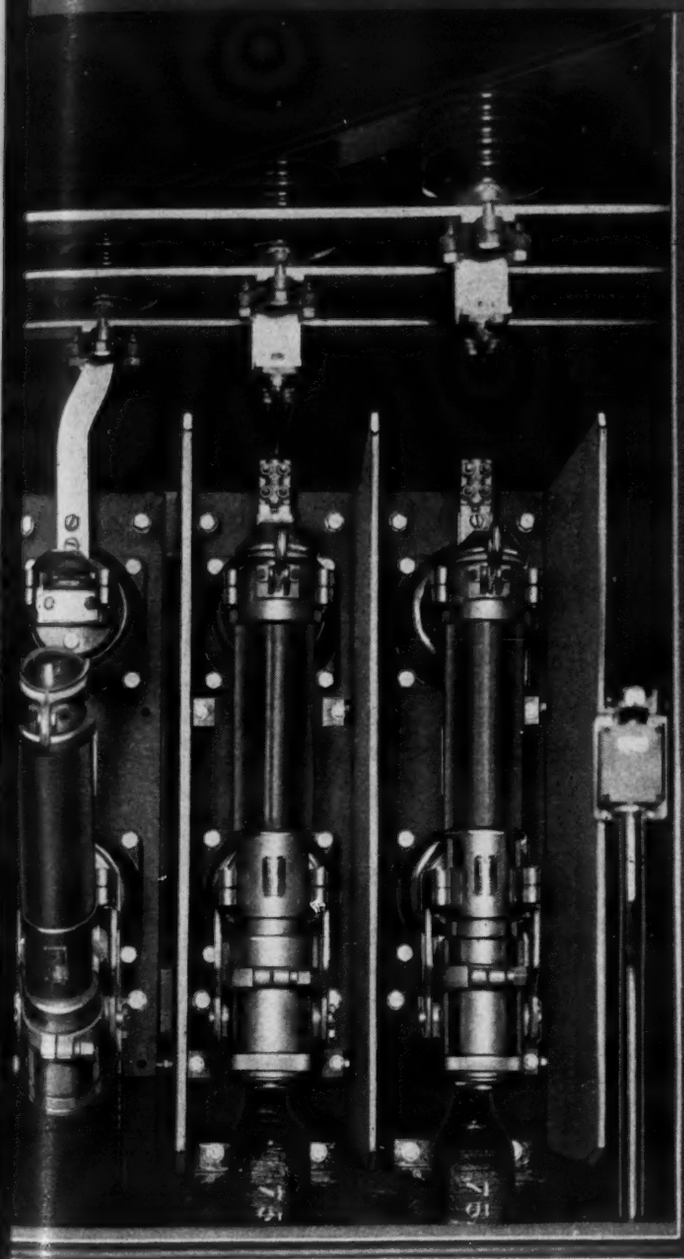
General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Division 436, Bloomfield, N. J.

Air Conditioning by

GENERAL ELECTRIC

POWER FUSES

Simplify Protection Problems



Present-day conditions have led to increasingly widespread use of S & C Type "SM" Power Fuses for system protection because they offer:

- **High short-circuit interrupting capacity (see table below)**
- **Relatively low initial and maintenance costs**
- **Savings in mounting space and installation time**
- **Tremendous saving in amount of critical metals required**
- **High reliability for protecting continuity of service to important war loads**
- **High initial and sustained accuracy in characteristics due to use of S & C silver fusible element.**

S & C Power Fuses are not destroyed when they operate, but are put back in service by replacing the re-fill unit, in which less than a pound of metal is used.

Type "SM" Fuse ratings are from 1 to 400 amperes, with short circuit interrupting ratings up to 1,000,000 KVA. They are made for indoor or outdoor service for use on 2300/4000, 6600, 13,200, 22,000, and 33,000 volt circuits.

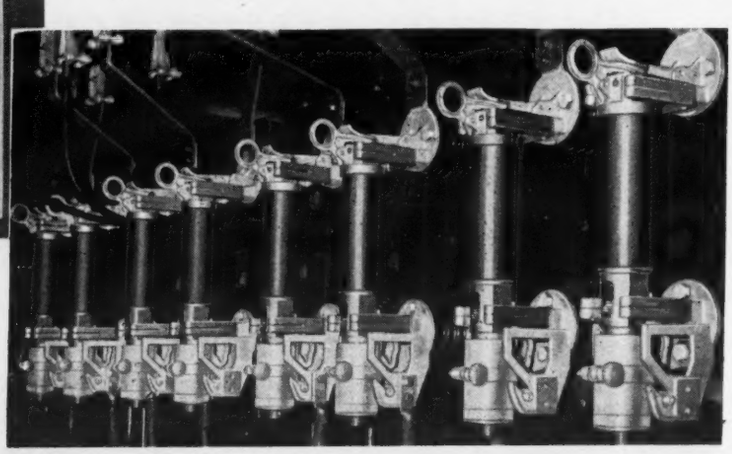
SHORT CIRCUIT-INTERRUPTING RATINGS IN R.M.S. AMPERES

Fuse Voltage Rating →		7,500	7,500	15,000	23,000	34,500
Circuit Voltage →		2,300/4,000	6,600	13,200	22,000	33,000
Type and Size of Holder	**SMPC-4	17,500	15,000	12,500	10,000	7,500
	SMP-4	27,500	25,000	20,000	15,000	10,000
	**SMPC 5	30,000	25,000	20,000	17,500	15,000
	SMP-5	40,000	35,000	30,000	25,000	20,000

**Equipped with Condenser

Refer to your Bulletin 200-E or write for a copy

SCHWEITZER & CONRAD, Inc.
4435 Ravenswood Avenue Chicago, Illinois



TYPE "SM"

POWER FUSES

flexible joints
Type XP for tubular bus.
Flexible connector for parallel group of laminated flat bars.
Special combined flat bar and connector and flexible joint.
Type XPL, a simple and inexpensive expansion joint for flat bar.
Flexible copper braid.

Patent No. 1,759,567

Flexible electrical joints, employing flexible copper braid, have long been used. Yet, *until Burndy conducted extensive laboratory tests, little was actually known concerning the current carrying capacities of the different kinds and arrangements of copper braids.*

The knowledge thus gained is at your disposal when you call upon Burndy for the correct type of flexible joint; whether for 'moving' electrical parts of heavy machinery — to forestall damage from settling foundations — to absorb expansion, contraction, or shock — to ground movable switch handles — or for other similar purposes.

Headquarters for connectors

Burndy

ELECTRICAL CONNECTORS ENGINEERED SPECIFICALLY FOR EACH NEED!

OVERHEAD • UNDERGROUND • POWER • WIRING • GROUNDING

BURNDY ENGINEERING CO., INC. · 107 EASTERN BOULEVARD, NEW YORK CITY

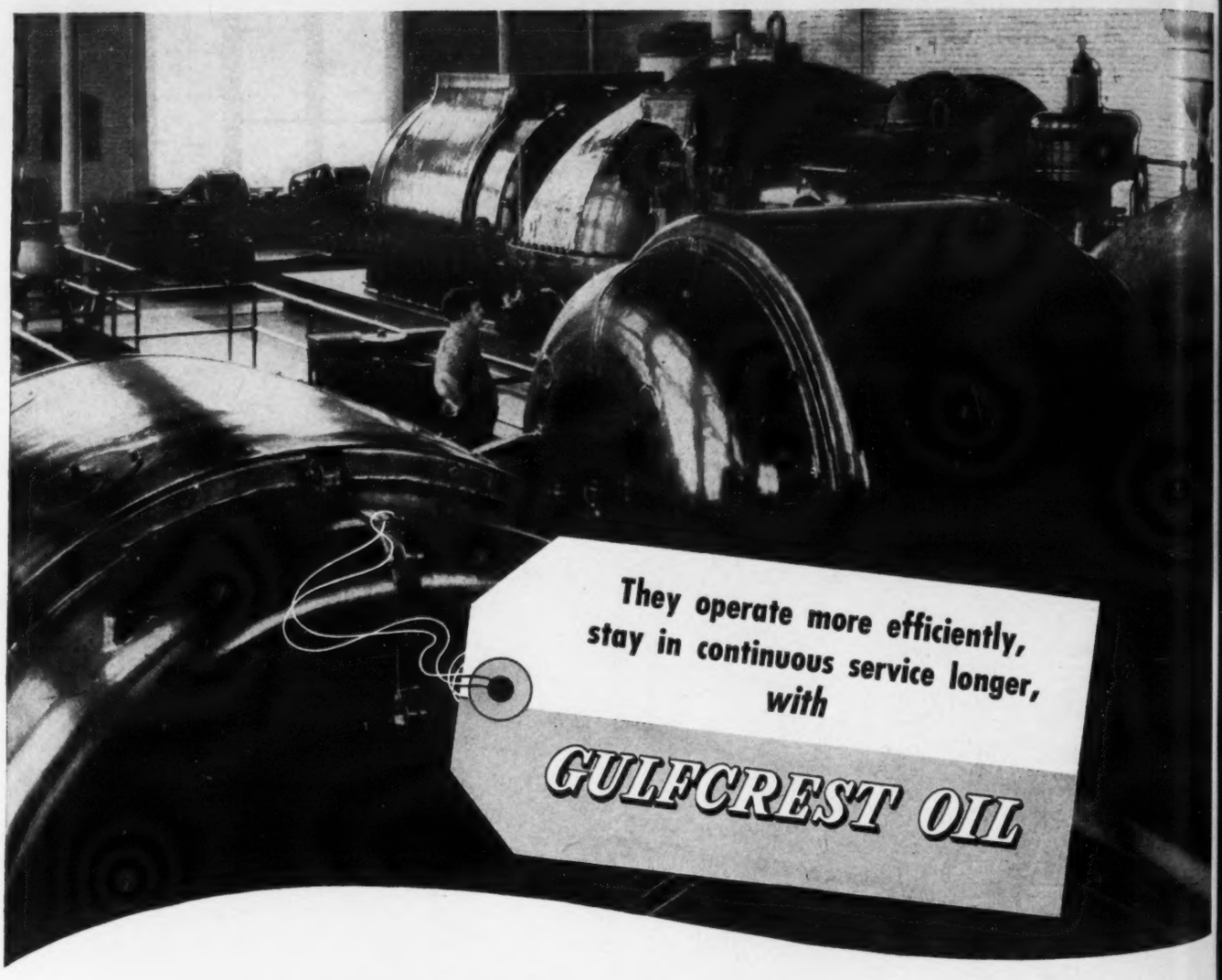
NO QUESTIONABLE PORCELAIN CAN SURVIVE THIS TEST

Lapp suspension insulator units, before being approved for shipment, must withstand the Overpotential Test, the industry's most severe test of porcelain quality. Its rim immersed in oil to prevent flashover, the unit is subjected to 60 cycle current at voltage higher than rated flashover value. Porcelain not up to the Lapp standard, punctures in this test, never gets a chance to fail on your lines. Units that survive are assured a definite dialectric factor of safety. The Overpotential Test is one of the many reasons that you do better with Lapp insulators on your lines. May we tell you the whole story? Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

ARMY (E) NAVY

Rotter Porcelain • Rotter Insulators



. . . *the only ALCHLOR PROCESSED turbine lubricant*

You are sure of better turbine protection and higher operating efficiency when you put Gulfcrest Oil in service. For this unmatched turbine lubricant is not only refined by modern conventional methods, but is super-refined by the Alchlor Process, the most effective method yet known for removing impurities and unstable hydrocarbons from oil—the undesirable constituents which cause oxidation and gum and sludge formation.

In addition to purifying the oil thoroughly, the Alchlor Process rearranges the molecular structure of certain of its hydrocarbons, making Gulfcrest Oil a lubricant of highest stability and endurance.

Evidence of the superior quality and higher lubricating value of Gulfcrest Oil is contained in the turbine operating and maintenance records of many of the leading power plants in the country. We suggest that you talk with the Gulf Lubrication Service Engineer in your vicinity about this unmatched turbine lubricant at your first opportunity. He will be pleased to give you complete details—and you will be under no obligation.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

WRITE YOUR OWN TICKET for

UPTEGRAFF TRANSFORMERS

TICKET

DELIVERY DATE _____

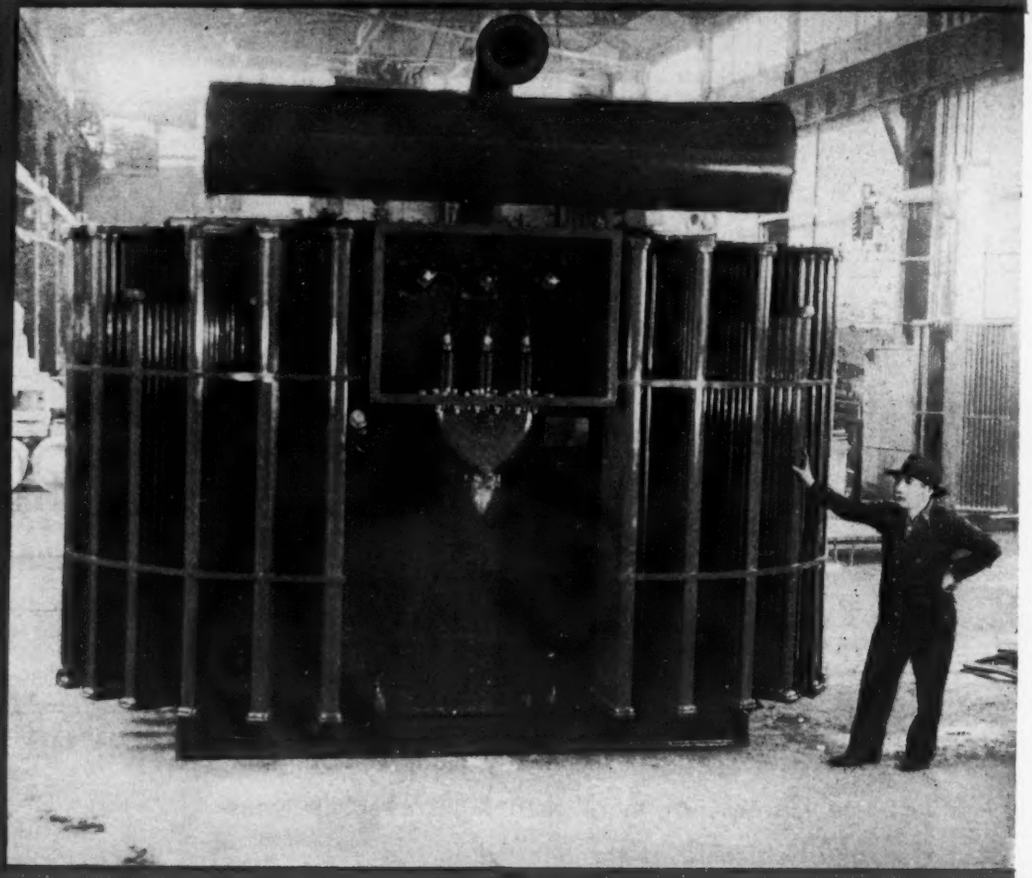
SPECIFICATIONS _____

_____

_____

_____

Watch us make it— or Better it!



We are manned with engineers and equipped in shop to get your Transformers to you as you want them, when you want them."

Tell us your needs.

R. E. UPTEGRAFF *Manufacturing Co.*

SCOTTDALE PENN'A · U.S.A.

"THEY'RE ALL IN THE ARMY NOW"

★ Over 1600 employees of the American Gas and Electric System are now in the Armed Forces. In whatever branch of our country's Services they may be, on land, on the sea or in the air—or if they are engaged in the essential war work of this War Industry—they are serving their country well.

In spite of the large number of employees in the Armed Services, we are producing more and more electricity for war. Last year our System delivery to industrial customers alone was nearly 7,000,000,000 h.p. hours—an increase of more than 70% over the year before the beginning of the Second World War.

Principal Affiliates

Appalachian Electric Power Company
Atlantic City Electric Company
Indiana General Service Company
Indiana & Michigan Electric Company
Kentucky and West Virginia Power Company, Inc.
Kingsport Utilities, Incorporated
The Ohio Power Company
The Scranton Electric Company
Wheeling Electric Company

AMERICAN GAS & ELECTRIC SERVICE CORPORATION

PROOF-TESTED

. . to 50% of the guaranteed minimum

Although the published strengths of all Locke Suspension Insulators are guaranteed minimums, you wouldn't think of loading them up to that value. But you can load them safely up to 50% of the guaranteed minimum because every unit is proof tested to that before it leaves the factory.

When you install Locke Suspension Insulators, you are installing a reserve strength that means greater immunity to damage, longer life and lower upkeep . . . which is one reason why comparative service records so invariably show more satisfactory performance from Locke Suspension Insulators.

Locke
COMPRESSION
GLAZED

PORCELAIN INSULATORS

LOCKE INSULATOR CORPORATION, BALTIMORE, MD.

Eggs for the Enemy

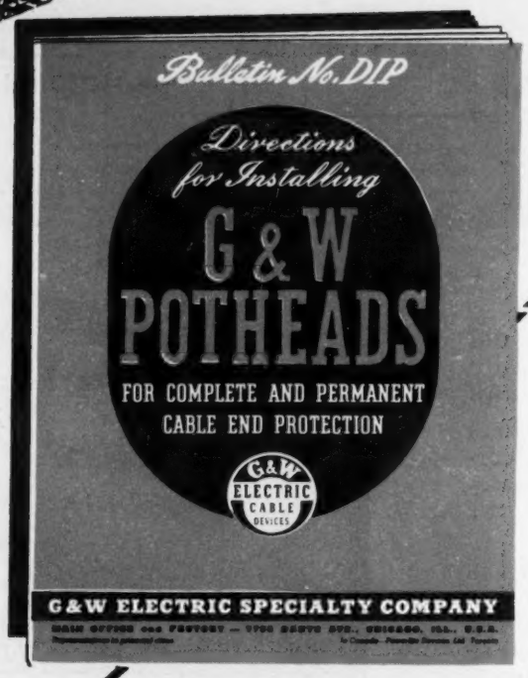
When this 4-motored bomber lays its eggs, it drops eight thousand pounds of destructive power, accurately directed. These are eggs that hatch when they hit. In making these 2000 lb. bombs, somewhere and somehow Chromel is used. We know this, because the purchaser has to name the product against which his high priority rating applies, entitling him to buy Chromel. These war production uses, of course, show why Chromel is not available for domestic heating devices. Meanwhile, for technical data on Chromel, ask for Catalog L.

HOSKINS MANUFACTURING COMPANY
DETROIT, MICHIGAN

Chromel
NICKEL CHROMIUM

HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

Send for Your Copy of



This bulletin gives directions for installing the various standard types and forms of G&W POTHEADS. It includes step by step installation procedure for the complete assembly, and also, detailed information on interchangeable fittings.

Each shipment of potheads will include one or more of these bulletins for the men who do the actual installation work. In addition, everyone interested in potheads should have a copy because the information regarding installation procedure will be helpful in selecting the proper type of pothead for a specific application.

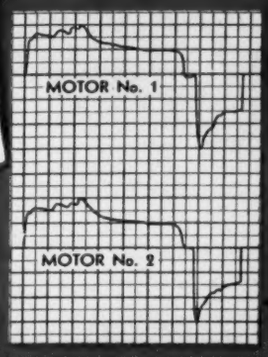
G & W ELECTRIC SPECIALTY COMPANY
7780 DANTE AVENUE CHICAGO, ILLINOIS
IN CANADA—POWERLING-DEVOES, LTD., TORONTO

G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

2 MOTORS operate as one with this EC&M DUPLEX Controller and SINGLE MASTER

96-ft. Span O.H. Stockyard Cranes



Graphic ammeter curves taken simultaneously of the 2-40 h.p. series motors on the bridge motion of these cranes are practically identical, showing that each motor takes its share of the load under any operating [illegible]

ON many crane and mill drives, it is common practice to employ two or more motors of the same horsepower rating which are mechanically connected through the gearing to drive the same load.

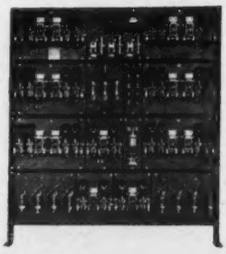
Although this dual method of motor drive offers many advantages, the control must be designed correctly to insure that the motors divide the load equally or severe strains on machinery or damage to the motors will occur.

EC&M *Duplex* Magnetic Control (with double-pole contactors) not only provides an independent circuit for each motor, but also insures equal division of the load by maintaining uniform values of current in each motor circuit under *any* condition—starting—accelerating—stopping or reversing.

Likewise, when bringing the master switch to the "off" position or when an overload relay trips, the brakes on each motor (as used on duplex hoists, etc.) are applied simultaneously, thus eliminating severe strains on the gearing, shafts, and bearing bolts that mechanically connect the motors.

For applications where four motors are operated in parallel and connected through the gearing to drive the same load, the EC&M *Quadruplex* Magnetic Controller (with 4-pole contactors) is available. Complete details on request.

EC&M Duplex Controller for D-c Motors, Bulletin 921 for cranes—Bulletin 925 for mill auxiliaries.



Also built for A-c wound-rotor motor drives in both duplex and quadruplex style—Bulletin 930.

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND OHIO

RADAR puts the finger on our enemies!

Hiding above the clouds there's a plane. Anti-aircraft guns let loose—down crashes the enemy bomber.

How can you hit enemies you can't see—through clouds, darkness and fog? The answer is Radar—radio detecting and ranging equipment.

How Radar does it

Radar sends out a wave which searches the sky or sea. When this beam hits a plane or ship, it bounces back to the Radar. Traveling with the speed of light, the beam makes this round trip in a few thousandths of a second and tells you . . . *there he is!*

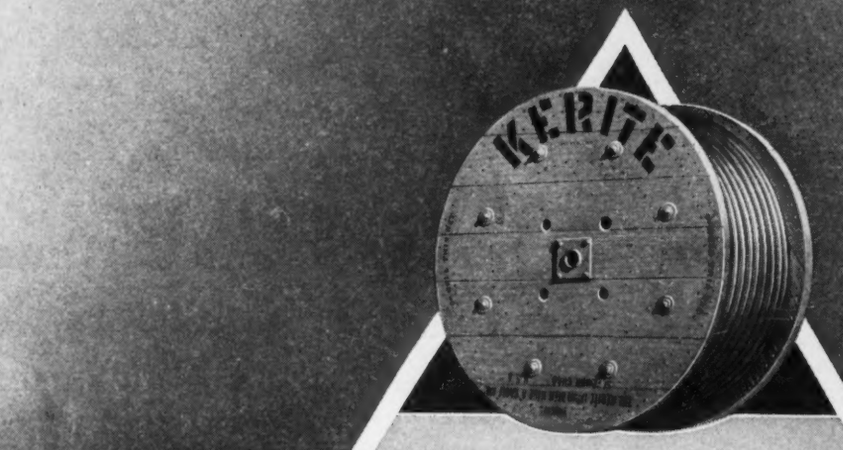
You keep the Radar focussed on him. It tells you his direction, distance, speed, whether he's climbing or descending. Having this information, gunners direct their fire with deadly accuracy.

★ ★ ★

Radar is the result of the work of many research groups in this country and abroad. Bell Telephone Laboratories has played an important part in its development. Western Electric today is one of the world's largest manufacturers of Radar.

Western Electric

IN PEACE . . . SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR . . . ARSENAL OF COMMUNICATIONS EQUIPMENT.



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The Most Important Phase of Planning

What are the utilities going to do after the war? What plans are they making? These are the questions we are frequently being asked, and the answer isn't easy to give because people are looking for something concrete.

For one thing the utilities aren't going to bring out a new kind of kilowatt-hour. They will have no new product of their own to sell as will other manufacturers, the prospect of whose new designs has caught the imagination of the public. Nor will the utilities have the problem of reconversion, as will most of their larger customers. There will be the difference of kinds of business that may again be served or promoted and there will be changes in methods as labor and materials again become available for civilian use, but the kilowatt-hours will flow on the same lines from the same stations.

In other words, the problem of changing from war to peace will be less disrupting to utilities than to almost any other major business. For that reason the term "post-war planning" does not have the same connotation to a power producer that it has to an electrical manufacturer, for instance. In fact, aside from the co-operative work that is being done with other local businesses to insure post-war employment, it may be said that there can be little or no post-war utility planning. The planning will be in preparation for what might happen when peace returns.

So far as physical expansion is concerned the utilities have always planned ahead, war or no war, on the basis of adding to plant when, if and as load warranted it. Time and place are not factors in such a philosophy.

When we come to the commercial side, the war will be found merely to have been an interlude, for the companies will take up where they left off. There will be this difference, however; each element of, or affecting, commercial activity will have been analyzed and changed wherever necessary to enable the department to get off to a good start. Planning here will assure the companies of flexibility to meet any and all conditions. By being flexible the companies are not going to be left flat if the post-war economic pattern doesn't happen to match some rigid planning.

There is a third phase to preparation for peace that is even more important, though little is ever said about it, and that is the return of executive critical attention to all phases of utility operation. For several years the attention of executives has been diverted to taxes, legislation, political attacks, regulation, labor disturbances. It is a healthy sign when the boss gets back into the real business of running the company and it is interesting to see the effect it is having on executive morale. The despondency that came from constantly being on the defensive is giving way to the inspiration that comes from looking ahead and putting one's house in order for the future.

That's the word—future. There is a future for the electric utility business. There is something to build for. All it needs to find it is a little looking—and the getting ready for peace is providing the looking.

Testing Generator Dielectric Absorption

Three new instruments devised to study the rate of deterioration of generator winding insulation under adverse humidity conditions of Brazilian plants

A. V. DeBEECH, Manager Engineering Department, Canadian & General Finance Company, Ltd., Toronto*

FOR the light and power companies in Brazil with which the writer is associated the subject of insulation life vs. operating temperatures has been a problem of major importance for a long time.

Investigations indicated the great desirability of finding some relatively simple tests that could be made periodically on the insulation, so that with the operating history and temperatures of the equipment we could obtain by actual experience some dependable data on the rate of insulation deterioration.

The high relative humidity always present in those parts of Brazil where our plants are situated causes the generator insulation to pick up considerable moisture even on short shutdowns, and it has always been a matter of speculation as to whether the moisture content had reached a point where it would be unsafe to place the unit in service without first resorting to short-circuit drying.

In order to make the tests three special instruments have been negotiated and bought.

Electronic Tester

After studying various types of equipment which had been used, we decided to obtain a tester (Fig. 1a) in which the high-voltage d.c. was obtained by electronic means and intrusted the building of the set to Fred M. Link, New York manufacturer of special radio apparatus.

To design the set, information was collected from a variety of sources; data supplied by R. L. Webb (Consolidated Edison Company of New York) and his associates were most helpful.

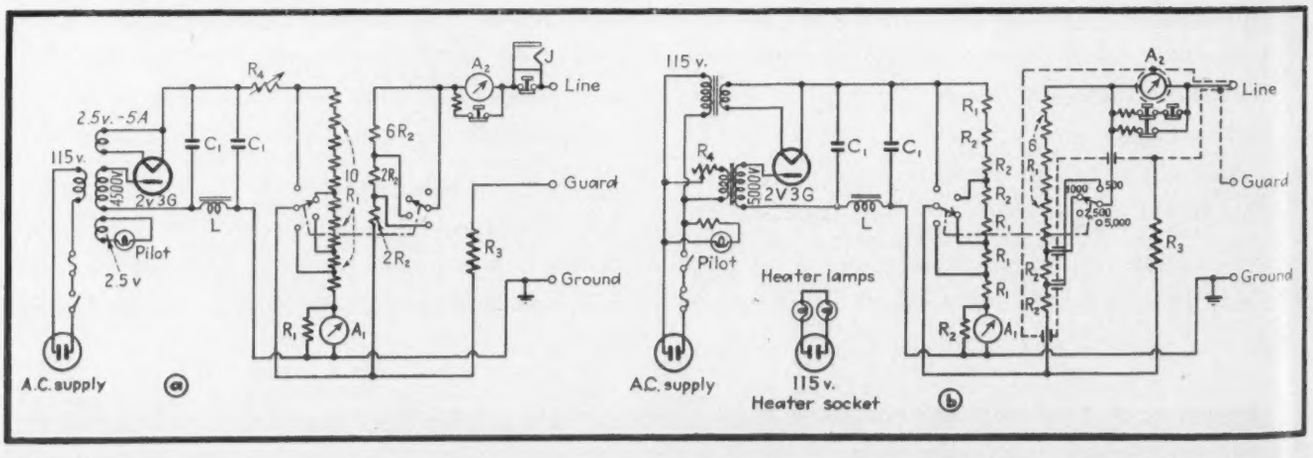
Transformer, choke and condensers used were standard parts for television apparatus designed for high voltages and very small currents. By the use of these components the size and weight of the set were considerably reduced.

The filtered d.c. output of 5,000 volts in series with a 0.5-megohm variable resistance put in for voltage

* Abstract of paper presented at recent meeting of E.E.I. electrical equipment committee.

FIG. 1—Forms of Link 5-kv. d.c. electronic tester of dielectric absorption

Element	Original (a)	Modified (b)
C_1	0.03 mfd., 7 kv.	0.03 mfd., 7.5 kv.
R_1	0.5 meg. 2 w. carbon	0.5 meg. 2 w. wire-wound glass-sealed
R_2	1 meg. carbon	1 meg. wire-wound glass-sealed
R_3	10 meg. 10-2 w. carbon	10 meg. 10-1 w. carbon
R_4	0.5 meg. 2 w. voltage control	50 w. rheostat (500 ohms)
L	1,500 h., 3 ma. choke	1,200 h., 3 ma. choke
J	External microammeter jack	.....
A_1	1 ma.	1 ma.
A_2	50 μ amp. 250 μ amp.	50 μ amp. 250 μ amp. 500 μ amp.



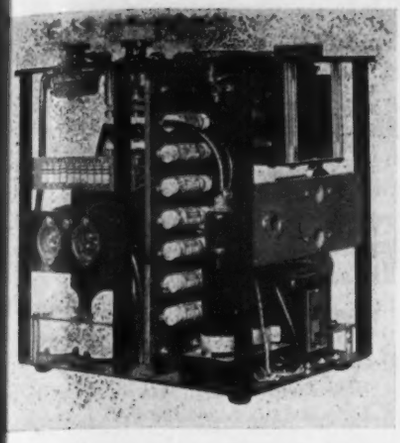


FIG. 2—Tester, including carrying case (not shown), weighs about 50 lb. Ammeter depressed and shielded against static charges

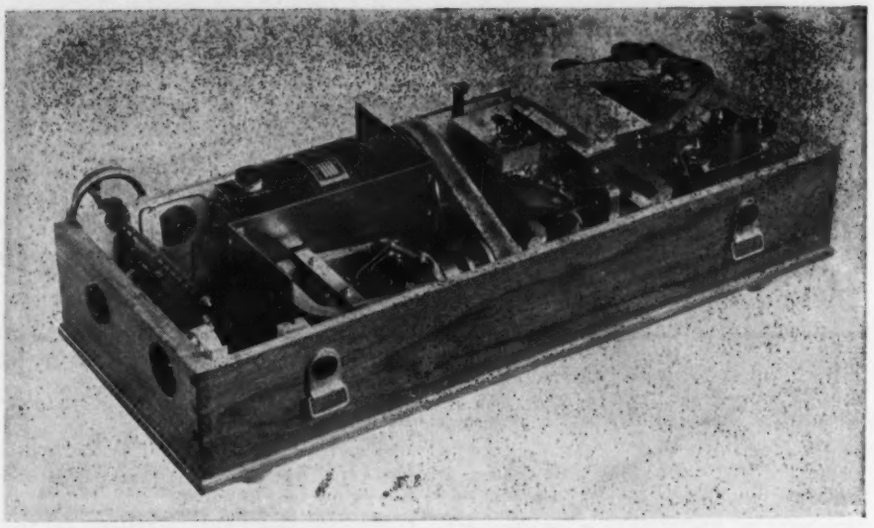


FIG. 3—Motor-driven 5,000-volt d.c. Evershed & Vignoles megger, weight 99 lb.

control is applied across a bleeder resistance. This bleeder serves a dual function: First, by means of three suitably located taps, it permits using the tester at lower voltages, thus making the range on this tester 500, 1,000, 2,500 and 5,000 volts; second, by providing a constant load on the rectifier, it minimizes voltage regulation effects due to changes in external load current during the course of a test. A bleeder resistance of 5 megohms is used, which at rated voltage represents a constant load on the rectifier of 1 milliampere. The external load current varies from a maximum of 400-500 microamperes at the start down to 10-15 microamperes toward the end of a test. The bleeder load reduces the percentage change in total current during a test.

A 1-mil. milliammeter in the ground end of the bleeder is scaled to read the tester voltage. A 0.5-megohm resistor in shunt with this milliammeter prevents an open circuit and abnormally high voltage should the milliammeter develop an open circuit.

Protective Resistance

One unit of a four-position two-gang switch is used to select the desired test voltage. The other unit selects suitable taps on a protective resistor in series with a microammeter between the center part of the voltage selecting switch and the line terminal for external connection.

This protective resistance is to limit current flow on short circuits. A value of 10 megohms was chosen, so that at 5,000 volts on short circuit the current was limited to twice full scale on the microammeter, which value can be handled for a short time without damage to the moving element. When changing to any of the lower voltage taps the value of this protective resistance is proportionately reduced, so that on any voltage range below 5,000 the short-circuit current equals full scale value.

Design Modified

Before work was started on a second set (Fig. 1b) it was felt that the original design should be changed to incorporate means of eliminating troubles which experience showed were present in the original tester.

When the first tester arrived in the field trouble was almost immediately encountered with the high-voltage connections and bushings of the power transformer, a standard product developed for television. However, in the humid conditions which are prevalent at our plants, it was only a short time before failures occurred, which were attributed to inadequate spacing of the internal connections and inadequate bushings which flashed over due to creepage. This trouble was corrected by placing the transformer in a larger case, which would permit greater spacing of the terminals, and then filling the case with compound. Larger bushings were also installed.

Carbon resistors have a tendency to change value erratically after some time, and as we felt that comparative data should represent test values taken under practically identical conditions, the new tester incorporated wire-wound precision-type resistors whose value could be counted upon to remain the same throughout their life.

Static Deflections

When the first tester was being inspected, after completion at the manufacturer's plant, it was found that static charges caused the action of the needle of the microammeter to be very erratic. Rubbing the fingers on the glass cover would cause the meter to read as high as 15 or 20 microamperes. This condition was corrected by making sure all metal parts of the meter case were in good contact and by installing a static shield, consisting of three wires, above the needle and immediately below the glass cover. These wires were connected to the metal case of the meter and the whole connected to the guard circuit and energized by the test voltage. Because of the danger from high voltage, it appeared undesirable to have this meter mounted in the usual way on the panel. This hazard was eliminated by mounting the meter below the panel and providing a second meter cover glass extending above in the usual way. However, in designing the meter housing, no means was provided in the first tester for zero setting of the meter through the false cover. This was corrected in the second tester by providing a hole above the set screw and placing a plug of transparent insulation in the

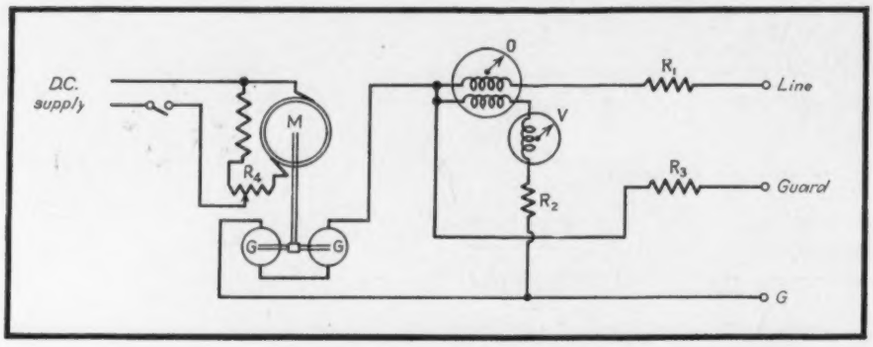


Fig. 4—Circuit details of 5,000-volt megger at Fig. 3

R_1 = 2 meg.; *R_2* = 2.4 meg.; *R_3* = 40,000 ohms; *R_4* = rheostat; *O* = 0-2,000-Inf. ohmmeter; *V* = 0-6,000v. voltmeter; *M* = motor; *G* = 2,500v. belt-driven generators.

hole. When adjustment is required the plug is lifted out and a special insulated screwdriver inserted.

Experience showed that 0.5-megohm variable voltage control did not give sufficient range of adjustment. In order to provide a wider voltage variation at this point it would be necessary to use a very large resistance, and therefore, in the second tester, it was decided to control the voltage on the low-tension or primary side of the power transformer. This change made it necessary to use a separate filament transformer. Experience indicates that this arrangement gives sufficient range of d.c. voltage control.

The new tester was also provided with an additional range of 500 microamperes. This also enabled us to reduce the amount of series protective resistance, thereby cutting in half the amount of voltage drop in this part of the circuit.

Voltage Regulator

Our experience with the voltage regulators has shown that while they do not prevent sudden momentary dips in the voltage from appearing in the rectified output, sudden changes do not seem to have any appreciable effect on the readings. After some use the output voltage of the tester seemed to drop. It has not been possible to account satisfactorily for this change, but it is thought that it resulted from an aging effect in the regulator, probably hastened by the rather low power factor at which the tester operates. It was necessary to install about 10 mfd. of condenser capacity in parallel with the input to the tester to restore the voltage to a satisfactory value. The regulators for the new tester were specially designed to match the characteristics of the tester and so far are giving better performance. To obtain the design data it was necessary to build the tester and then put it through its performance. The complete tester (shown without case in Fig. 2) weighs approximately 50 pounds and is 15 in. wide, 18 in. long and 20 in. high. The regulators are separate pieces of equipment and weigh about 18 lb. each.

Motor-Driven Megger

When we first became interested in the matter of dielectric absorption testing we approached the firm of Evershed & Vignoles regarding a 5,000-volt, motor-driven megger. This firm advised us that it had never made such an instrument, but was interested in our problem.

The megger (Fig. 3) is essentially a megger such as has been available for years, but differs in the following respects. The power supply consists of a 250-volt d.c. motor with field control, belt-connected to two 2,500-volt generators connected in series.

A d.c. motor drive was selected to avert clutch complexities incident to use on both 50- and 60-cycle systems. Station control batteries provide an essentially constant d.c. source in all plants where this megger would be used.

In addition to the usual instrument provided in the meggers for reading megohms, in this case 0–2,000 megohms and infinity, a milliammeter scaled in volts was added in the potential coil circuit so that should any variation in the d.c. voltage occur, this would be reflected in the generator output voltage which is directly proportional to the speed of the driving motor. As any change in the field resistance of the d.c. driving motor will affect its speed and, therefore, the generator output voltage, it is necessary before starting a test to run the megger until its temperature becomes constant. This requires about ten minutes. When this has been done the speed is adjusted by the motor field rheostat until the generator output voltage is 5,000 volts d.c. and then left there.

When first run, after arrival in the field, a flashover occurred between a washer on the voltmeter mounting and a pole on one of the generators. This was overcome by increasing the clearance and putting in a barrier of mica. In addition, as a precautionary measure, it is proposed to substitute automobile ignition wire for the varnished-cambric-covered wire with which the connections are now made. At the same time provision will be made to furnish a means of changing the belt on the generator drive without requiring that the sealed cover of the instrument be removed.

The motor-driven megger weighs in the neighborhood of 99 lb., as compared with the electronic tester weighing about 50 lb.

Experiences

Both the second electronic tester and the motor-driven megger give higher resistance readings than the original tester. This is believed to be due to leakage still present in the old set.

The amount of leakage present at the beginning of the test is estimated as a fixed reading on the microammeter and this reading is subtracted from the test values obtained during the course of the test. However, there is no way of knowing the manner in which this leakage may be affecting the readings during the test and this is a possible source of error.

It has also been noted in conducting a test with the motor-driven megger that it is not as easy to read the 0–2,000-megohm scale above 10 megohms, due to its logarithmic type of calibration, as it is to read microamperes directly on the other testers. However, a separate microammeter has been purchased and will probably be used with the megger, thus enabling readings of current to be taken as with the electronic type.

Nitrogen Rejuvenates Belted Paper Cable

K. TASHJIAN and C. H. HUNTER,* Cincinnati Gas & Electric Co.

WITH the scarcity of copper, and with increased loads on cables brought about by the war emergency, means to increase cable loads, without exceeding temperatures detrimental to cable insulation, are being given more consideration. The particular type of cable with which we are concerned was manufactured about 1916, is of 400,000 cir.-mil, three-conductor, round, stranded copper conductors and $\frac{7}{32}$ x $\frac{7}{32}$-in. belted paper insulation rated at 15 kv.

Dielectric losses of this rosin-base cable are high and limit its current-carrying capacity. Since there are a number of cables of this vintage in service on our system, it was decided to make laboratory tests to determine the effect of nitrogen† gas on cable dielectric losses. The test results are presented only as a preliminary study that may be of interest to the cable engineer.

It is not certain, however, whether results on reel lengths of cable will approximate those of the short lengths just presented. For additional data full reel length tests would be in order. Ionization tests also should be made both on short and long lengths.

Several reel lengths of cable were removed from feeders in service. From these 12-ft. samples were cut for test. All of the cables tested represent three manufacturers and the cable found to have the higher dielectric losses was selected for the nitrogen gas tests.

Power-factor measurements were made with 13.5-kv., single-phase voltage and the equivalent three-phase losses were calculated.

Cable temperature was maintained with the use of a thermostatically controlled electric oven having a maximum range of 120 deg. C. A period of three hours elapsed between temperature changes to allow the copper to attain the same temperature as the sheath.

Power-factor vs. temperature measurements starting at room temperature to 120 deg. C. in steps of 20 deg. C., were made for the cable as removed from the field. Following the above run, the cable was evacuated for a few minutes to remove all the entrapped air; then, nitrogen gas was introduced at a pressure of 1 psi. above atmospheric and a second power-factor-temperature run made. The third, and final run, was made with the nitrogen pressure increased to 15 psi.

Total loss (copper loss plus dielectric loss) in watts per foot of cable at various loads is shown in Fig. 3. At copper temperature of 90 deg. C. the total three-phase loss at zero current for 15-psi. nitrogen gas was found to be 1.8 watts per foot, while the total loss of the original rosin-base cable is 3.5 watts per foot. Increase in current-carrying capacity due 15-psi. nitrogen gas is about 10 percent.

* Both junior engineers, Electric Distribution Department.

† A. I. E. E. Paper 39-71, "Low Gas Pressure Cable," by G. B. Shanklin.

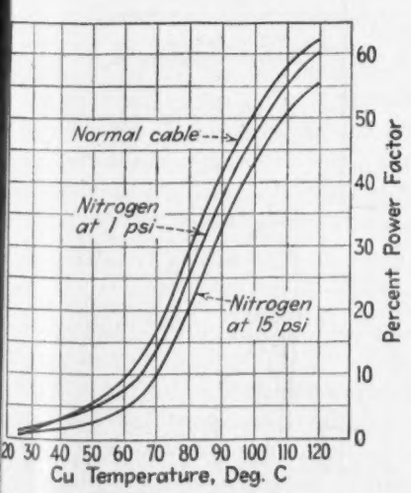


FIG. 1—Lower dielectric loss at 15 psi. of nitrogen gas following a 1 psi. run

When the sequence was reversed the curves for gas were nearly coincident.

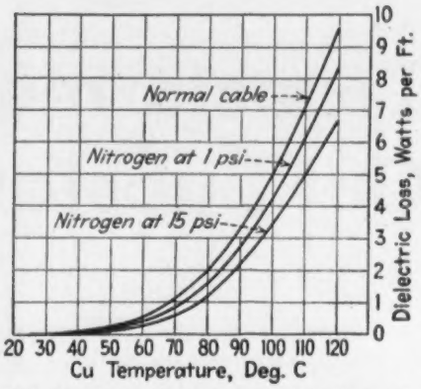


FIG. 2—Calculated equivalent 3-phase dielectric losses (zero load current) for samples of Fig. 1

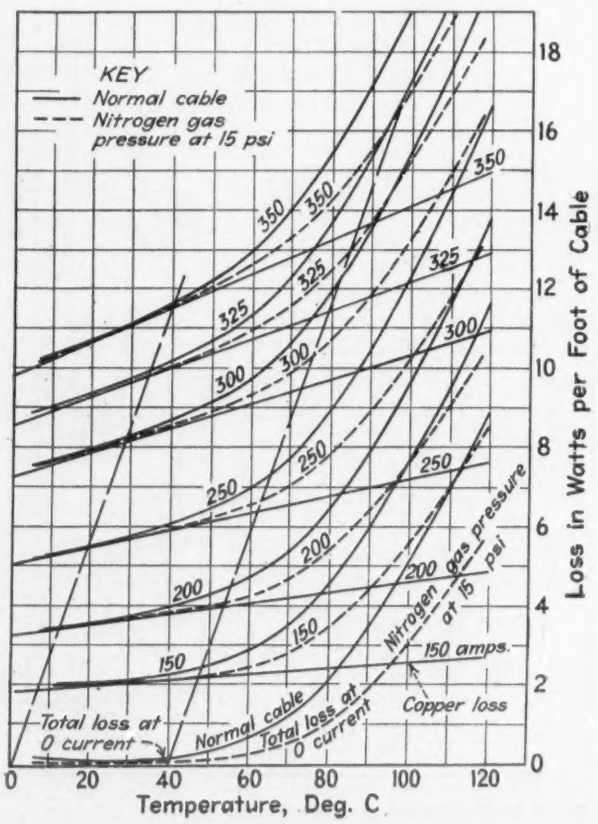


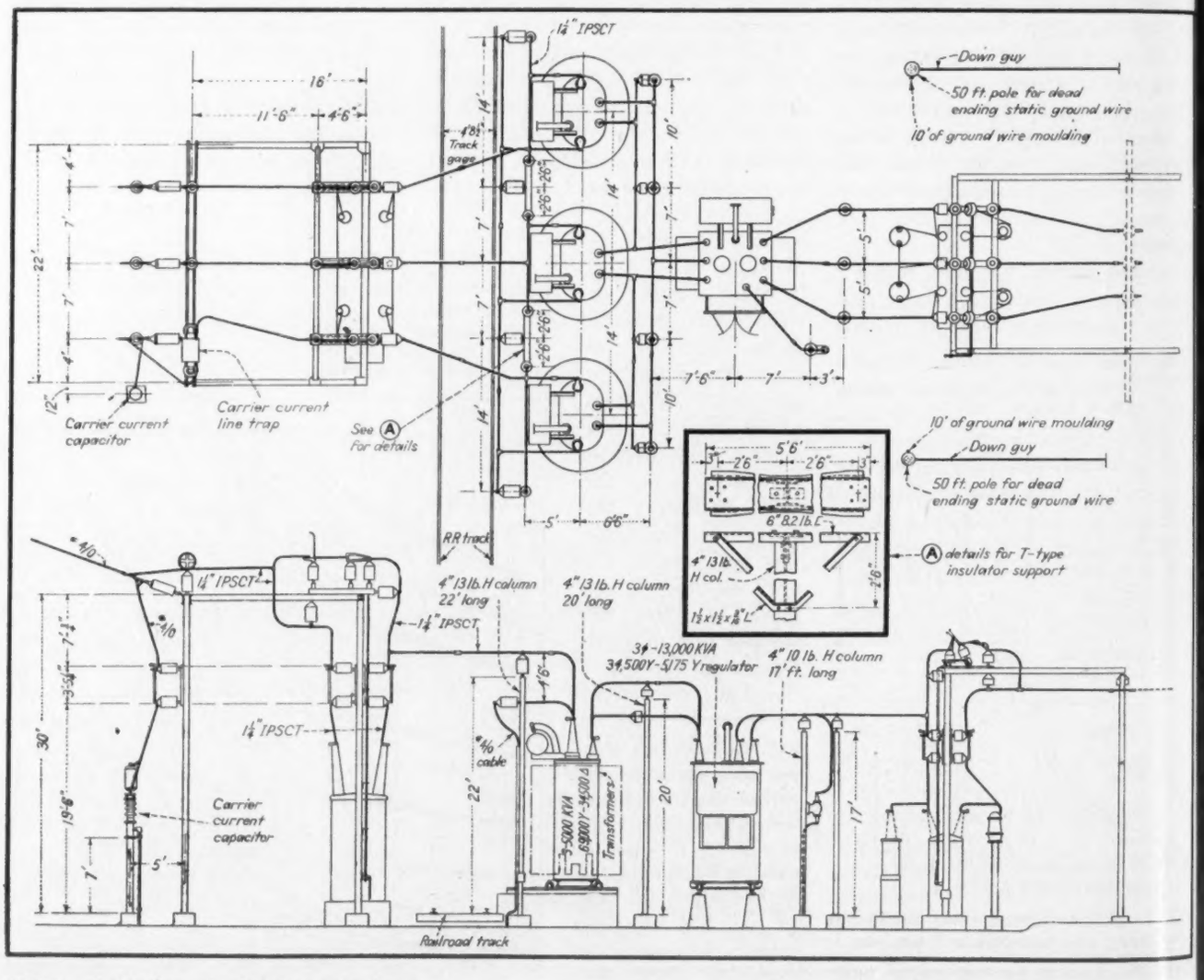
FIG. 3—Total loss (copper plus dielectric) for various ampere loadings and temperatures

Oblique lines start at ambient temperature and have slope of 3.5 deg. per watt (rate of heat dissipation for this cable); intercepts with total loss curves give copper temperature.

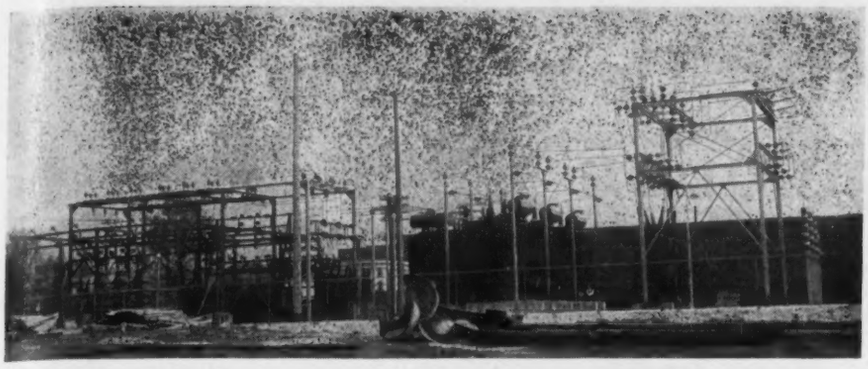
Transformer Buses on Columns Cut Substation Steelwork in Two

Simple column-supported transformer buses in substation extension drastically reduce steel needs — Novel arrangement provides ample clearance and yields clean and functional arrangement

H-SECTION steel columns used to support high- and low-voltage transformer buses associated with a bank of three 5,000-kva., 69/34.5-kv., wye-delta-connected transformers and a 15,000-kva., three-phase regulating auto-transformer in extension of a 34.5-kv. substation made it possible for engineers of the Central Illinois Public Service Company to cut steel requirements in two without sacrificing clearance for maintenance or removal. The resulting bus support structure, shown herewith, is not only economical of steel but symmetrical


1¼" IPSCT
Down guy
50 ft. pole for dead ending static ground wire
10' of ground wire moulding
Carrier current capacitor
Carrier current line trap
See (A) for details
RR track
4" 13 lb. H column 22' long
4" 13 lb. H column 20' long
3φ-13,000 KVA 34,500Y-5/175 Y regulator
4" 10 lb. H column 17' ft. long
#1/0
#1/0 cable
3-5000 KVA 69000Y-34500Δ Transformers
Carrier current capacitor
Railroad track
(A) details for T-type insulator support
6" 8.2 lb. L
4" 13 lb. H col.

PLAN and elevation of substation extension



CONTRAST the steel work in the new 69-kv. portion of the substation (center and right) with the older 34.5-kv. portion at left; note the overhead ground wires dead-ended on poles at center of picture

and simple in arrangement and typifies an incipient trend in substation design toward cleaner and more streamlined construction.

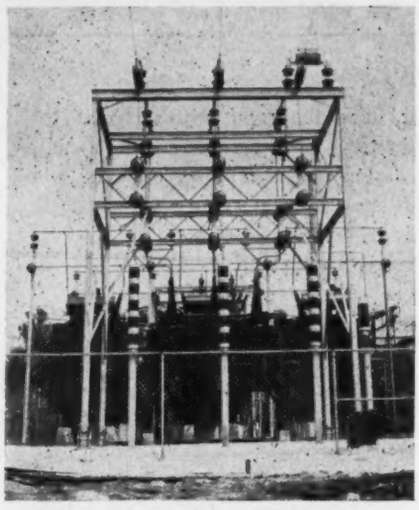
Bus Supports

Primary side of the transformer bank is wye-connected. High-voltage conductors, consisting of 1¼-in. IPS copper tubing, are led from the transmission take-off structure at the west end of the substation to the transformer bus supports. These consist of four 4-in., 13-lb., H-columns mounted in line about 5 ft. from the center line of the transformer bank.

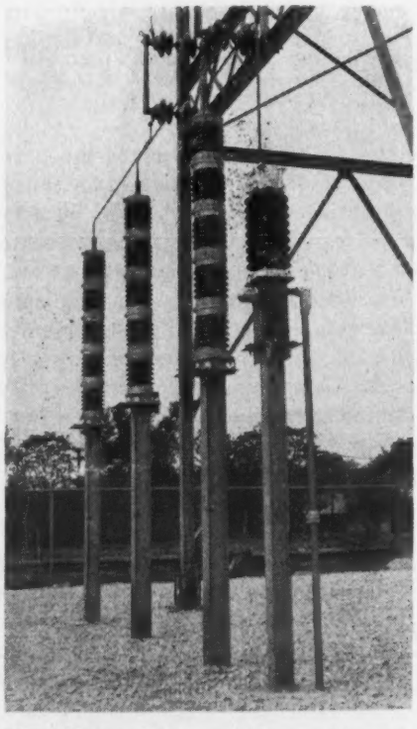
To arrange the 69-kv. bus for simple wye connection the three phases are brought in to short "stub" buses supported between the four columns. The common connection for the wye is a single-tube bus on side-mounted insulators on the four columns. The two center columns, where two insulators are necessary to support the ends of the phase buses, carry a short length of channel bolted in T-configuration to the top of the column and to which the pillar insulators are attached.

Appropriate taps lead from the phase buses and common connection to the primary bushings of the transformer, as shown.

The 34.5-kv. secondary buses of the transformer bank are similarly column-supported, but modified for the delta connection. Similar columns support the leads running from the secondary of the auto-transformer to the existing portion of the low-voltage substation.



THE 69-kv. bay looking east; transmission take-off structure is in foreground



THE 69-kv. lightning arresters and carrier-current telephone coupling capacitor, foreground, are also column-mounted

From a strength standpoint, while the column-type bus supports are not as rigid as a more conventional structure where steel is used generously, it was felt that the relatively heavy H columns, as vertical cantilevers, were sufficiently strong when considered in conjunction with the 1¼-in. tubular bus and sturdy insulators to stand any abnormal loading to which they might be subjected. This substation has been in operation for two years and no conditions adverse to the design have appeared.

•

Bi-Monthly Billing—a Correction

In transcribing copy for the article "Will Bi-Monthly Billing Help the Utility Manpower Problem?" by David Robertson, Detroit Edison Company, and printed in ELECTRICAL WORLD, February 20, 1943, several lines of data and text were lost. The omission occurred after the paragraph beginning "It is doubtful if customer relations . . ." and ending ". . . collection group would be affected as follows," in the third column on page 54 of the issue containing the published article.

The following material should have appeared at this point:

"Expense: Labor	10%
Supplies	29%
Total operating	10.7%
Agency work	90%
No. of employees	13.1%

"Commercial offices: The Detroit Edison Company has 75 business offices scattered throughout the Detroit area where company business, including bill payment, can be conducted. Sixty percent of all customers who come to the offices to pay bills transact some other business. A change to monthly billing would increase the burden on these offices as follows:"

Thus the data of 43.5 percent, etc., refer to operations of commercial offices and not to the collection group as appears in the article.

In the first column of the same page, second paragraph from the bottom, there is another error. It is printed that "29 percent of all residence customers pay a bill of less than $4.23"; this figure should be $4.32.

Trends Toward Destruction of State Regulation*

Federal control of utilities usurping the powers of states in spite of legislation marking out jurisdiction — Analysis of recent decisions showing trends

JAMES W. WOLFE

THE electric industry grew to be one of the leading industries of the nation under state regulation, and without any federal regulation whatever. Are there now developments taking place which point toward the destruction of state control of this industry and its complete subjection to federal control? I believe the answer to that question is in the affirmative.

If this is true, are these developments occurring by reason of legislation designed for that purpose, enacted by Congress in response to a recognized public need and public demand? I believe the answer to that question is in the negative.

I propose briefly to touch on the legislation which Congress enacted providing for a degree of federal regulation of the electric industry, and upon certain developments which have followed the enactment of that legislation, which seem to me to justify the conclusions I have just announced.

Whether the governmental power to regulate utilities in the hands of federal bureaus shall be increased by legislation, by the administrative action of such bureaus themselves, and by supporting opinions of the federal courts, will depend in the last analysis upon public opinion. If the public is quiescent, the enlargement of federal power will continue. If, on the other hand, the public becomes awake to the fact that its government is being transformed, and if it disapproves and registers its disapproval in political action, a halt may be called.

The Federal Power Act was passed in 1935. I believe it to be plain that Congress had no intention of withdrawing governmental powers from the states and vesting them in the Federal Power Commission. The very first section of the Federal Power Act is in part as follows:

> SECTION 201—(a) It is hereby declared that the business of transmitting and selling electric energy for ultimate distribution to the public is affected with a public interest, and that federal regulation . . . is necessary in the public interest, such federal regulation, however, to extend only to those matters which are not subject to regulation by the states.
>
> (b) . . . The commission shall have jurisdiction over all facilities for such transmission or sale of electric energy, but shall not have jurisdiction . . . over facilities used in local distribution or only for the transmission of electric energy in intrastate commerce.

This appeared to declare the purpose of Congress to retain to the states regulation of the business of electric utilities, which they were competent to regulate before the act was passed. Notwithstanding this plain language, however, the Federal Power Commission, in the Jersey Central Power & Light Company case, asserted jurisdiction over an electric utility in New Jersey, all of the property of which is located in New Jersey, which sells no electric energy outside of New Jersey, or to be transmitted from New Jersey.

I do not understand that anybody questions that New Jersey could regulate all the business of that company, prior to the enactment of the Federal Power Act, including its sales to consumers and to other New Jersey utilities, and its issues of securities, and its other corporate acts, and I point out that the Congress had specifically declared that federal legislation to be provided by the act was to extend "only to those matters which are not subject to regulation by the states."

The basis of the Federal Power Commission's claim of jurisdiction in that case was this: The Jersey Central Power & Light Company sells energy to the Public Service Company of New Jersey. That company connects with the Staten Island Electric Company in New York, and it sometimes happens that energy generated by Jersey Central, and sold by it to the Public Service Company, slops over to Staten Island and is consumed in New York.

A Devastating Opinion

This decision was sustained by the Court of Appeals for the Third Circuit, in an opinion which recognized the inevitable transmission of electric energy, by this slop-over process, when electric systems are connected. It is an opinion which is devastating in its extension of the reach of the jurisdiction of the Federal Power Commission.

The opinion points out that not only are Jersey Central, Public Service and Staten Island so connected as to permit energy to flow from one system to another, but that the transmission systems of those companies in turn are connected "with other electric transmission systems covering the southern part of New Jersey, the southeastern part of Pennsylvania, the northeastern part of Maryland (and) Delaware," and goes on to say:

> Since these various electric utilities systems are interconnected, it is obvious that there will be some inci-

*Taken from an address before May 12-13 Conference Southeastern Electric Exchange. Mr. Wolfe is vice-chairman of the South Carolina Public Service Commission and a past-president of the National Association of Railroad and Utilities Commissioners.

dental or slop-over current passing through the various system connections, including the busbar at the Mechanic Street substation, which comprise the connections between Jersey Central and Public Service on the one hand and Public Service and the Staten Island company on the other (R. 1118).

This slop-over movement of energy between connected systems is inevitable when the circuit is closed which causes the connection. The legal effect of such inevitable movement, when energy thus passes over a state line, is to make all of the connected companies, over the lines of which the energy moves, public utilities subject to the Federal Commission. Discussing the movement from Jersey Central, the court said:

> Once the circuit between the Jersey Central generating plant and the Staten Island company was closed, inevitably electricity flowed from Jersey Central to the Staten Island company. That result was . . . unavoidable. The fact that Jersey Central sold this electricity to Public Service rather than to Staten Island does not serve to put the flow out of commerce. . . . It is electricity which is transmitted from New Jersey to New York. It follows that Jersey Central is a public utility within the meaning of Section 201(e) of the act.

It will be perceived that the judgment of the court clearly means that these connected utilities, because of the "inevitable" movement of electric energy from system to system, and, in some measure, across state lines, are all subject to regulation by the Federal Commission.

The same interconnection of electric utilities is general throughout the country, and the threatened effect of the construction thus placed upon the Federal Power Act by the court, is to bring under the regulation of the Federal Commission practically all of the public utilities of the several states.

I am unable to escape the conviction that the construction thus placed upon the Federal Power Act by the Court of Appeals does violence to the plainly expressed purpose of Congress. That, however, is only my personal view. It is not sustained by the U. S. Supreme Court. That court, by a six-to-three decision, sustained the Court of Appeals judgment, and the Federal Power Commission's claim of jurisdiction.

In the dissenting opinion Justice Roberts, speaking for himself and for Mr. Justice Frankfurter, said in part:

> This I think is not a fair construction . . .. I can find no support in the language, history or avowed purposes of the act for such a construction. Moreover, it is flat contradiction to the words of Section 201(a), (b) and (c), which, when taken together, explicitly exclude from the jurisdiction of the commission (a company such as this).

The decision of the Federal Power Commission in the Hartford Electric Light Company case is another development to which I will refer.

The Federal Power Act, as it passed the Senate, was drawn to be applicable to "the production of electric energy." The House, however, determined to exclude generation from the jurisdiction of the Federal Power Commission. The House committee, accordingly, redrafted the bill and eliminated the words "production of energy" from paragraph (a) of Section 1, and redrafted paragraph (b) to exclude expressly from the commission's jurisdiction "facilities used for the generation of electric energy." As so redrafted, the bill passed.

Hartford Decision

Notwithstanding that legislative history, and that language in the act, the Federal Power Commission, in the Hartford Electric Light Company case, asserted jurisdiction over that company because of sales made by that company to another Connecticut company, where the energy sold was delivered at the bushings on the wall of the generating station.

In that case the purchasing company sold some of the energy received for use in another state. Because the transmission from the power plant of the Hartford company to the interstate destination was instantaneous, the commission held the sale of such energy by Hartford was an interstate sale.

In the Federal Power Act, however, the Congress had provided that the commission should have jurisdiction over sales only where the selling company owned or operated "facilities" subject to the commission's jurisdiction. Also, as I have pointed out, the plain language of the act excluded "facilities used for the generation of electric energy" from the commission's jurisdiction, and this sale was made at the very wall of the generating station.

The purpose of the exclusion of generating facilities by Congress seems plain to a layman like myself. Congress did not intend the commission to regulate generating companies.

The commission, however, asserted jurisdiction upon the ground that the company's "corporate organization . . . its books of account (and) its instrumentalities for billing and collecting" are facilities for the making of the company's interstate sales, and operated to give the commission jurisdiction.

The Court of Appeals for the Second Circuit sustained the commission's claim of jurisdiction upon the ground claimed by the commission, and the U. S. Supreme Court on May 3 refused to review that judgment, leaving the same in effect.

The Federal Power Act expressly limits the jurisdiction of the Federal Power Commission to interstate sales at wholesale, which are defined as sales for resale. The obvious purpose was to leave rates to consumers to be regulated exclusively by the states, and this purpose was clearly stated by the House committee in its report on the bill. The committee said:

> The new Parts (II and III) are designed to meet the situation which has been created by the recent rapid growth of electric utilities along interstate lines. . . . under the decision of the Supreme Court of the United States in *Public Utilities Commission* v. *Attleboro Steam & E. Co.* (273 U.S., 83), the rates charged in interstate wholesale transactions may not be regulated by the states. Part II gives the Federal Power Commission jurisdiction to regulate these rates. A "wholesale" transaction is defined to mean the sale of electric energy for resale and the commission is given no jurisdiction over local rates even where the electric energy moves in interstate commerce. . . .
>
> The bill takes no authority from state commissions and contains provisions authorizing the Federal Commission to aid the state commissions in their efforts to ascertain and fix reasonable charges. . . . Probably no bill in recent years has so recognized the responsibilities of the state regulatory commissions as does title II of this bill. (House of Representatives Report No. 1318, 74th Congress, 1st Section.)

The Federal Power Commission has not yet made an order undertak-

ing to prescribe rates for any sale directly to a consumer, but its proceedings in a case now pending before the commission are causing serious concern to those who desire to see state rights preserved. I refer to the Arkansas Power & Light Company case.

In that case, as many of you know, the principal power companies serving in the Southwest, at the instance of a government agency, the Defense Plant Corporation, formed a power pool to enable the Arkansas Power & Light Company to sell to Defense Plant Corporation a temporary emergency supply of electric energy, to enable that corporation to operate its aluminum plant at Lake Catherine, Ark., until its own generating facilities should be constructed.

The terms of the pooling agreement, and likewise of the sale to Defense Plant Corporation, were worked out under the control of Jesse Jones and were believed to be very favorable to the government.

Arkansas Investigation

Because the pooling contract covered sales made in interstate commerce to Arkansas Power & Light Company for resale to Defense Plant Corporation, that contract was filed with the Federal Power Commission as a rate schedule and it was designated by the commission as "Arkansas Power & Light Company Rate Schedule FPC No. 12." The contract between Arkansas Power & Light Company and Defense Plant Corporation, however, was filed with the Arkansas Department of Public Utilities in Arkansas, where Defense Plant Corporation receives its power. After such investigation as that commission felt to be necessary and desirable, that contract was allowed to take effect as a rate schedule, and the service provided for therein is being supplied.

On September 1, 1942, the Federal Power Commission, on its own motion, and so far as I am aware without complaint from any source, instituted an investigation to determine, as its order instituting the investigation declared, "whether any of the rates under said Federal Power Commission Rate Schedule No. 12, or 'any rule . . . *or contract affecting such rate* . . . is unjust (or) unreasonable . . . and . . . If the commission shall find that any such . . . contract affecting such rate is unjust . . . to determine the just and reasonable . . . contract to be thereafter observed and in force and *to fix the same by order.*'" [Italics supplied.] A hearing was begun in Little Rock before the Federal Power Commission's chief trial examiner on December 14, 1942, which, subject to some adjournments, continued to February 5, 1943, and the inquiry at that hearing, I am informed, was directed chiefly to the reasonableness of the rate charged to Defense Plant Corporation.

NARUC Intervention

The Arkansas Department of Public Utilities objected to such evidence upon the ground that its jurisdiction over such rate was exclusive, and moved to have the evidence excluded. Such motion, however, was denied. So greatly concerned are the state commissions over this proceeding that the executive committee of the National Association of Railroad and Utilities Commissioners, upon which I have the honor to serve, instructed our general solicitor to file a brief supporting the position of the Arkansas Department of Public Utilities. Such a brief has been filed. The case has not yet been argued. No one can foretell what action the Federal Power Commission will determine to take.

These developments to which I have adverted are disturbing to those who would preserve our dual government, in fact as well as in form, and they may well be disturbing to public utilities whose business is local but who may find themselves suddenly called upon to meet the requirements of a federal bureau in Washington.

In conclusion, let me say that it is not easy to foresee how far the commission may go under a grant of power which appears to be designed for a very unobjectionable purpose. For example, Section 202 (c) of the Federal Power Act provides, in part:

> **During the continuance of any war in which the United States is engaged, or whenever the commission determines that an emergency exists by reason of a sudden increase in the demand for electric energy, or a shortage of electric energy or of facilities for the generation or transmission of electric energy, or of fuel or water for generating facilities, . . . to require by order such temporary connections of facilities and such generation, delivery, interchange, or transmission of electric energy as in its judgment will best meet the emergency and serve the public interest.**

Upon the face of this provision its purpose would be taken to be to enable the meeting of an emergency need for power in any section, arising from war or from some other unusual occurrence, *for the period of the emergency*. It would scarcely be supposed that an electric utility might be required to transmit electric energy into its own market to enable some other seller of such energy to undersell that electric utility in that market. Indeed, under state regulation, utilities are ordinarily protected against invasion of their markets so long as they serve them in the manner provided by law. Under the provision which I have quoted, however, the Federal Power Commission recently made an order requiring the Washington Water Power Company to transmit energy for the Bonneville Power Administration for sale to War Department agencies near Spokane, in territory served by Washington Water Power Company. This order was made, not upon a finding that such transmission was necessary to relieve an emergency, but upon the ground that the Bonneville Administration had submitted "a considerably lower bid" for supplying such power than that submitted by the Washington Water Power Company.

President's Directive

The Federal Power Commission explained that it took such action in conformity with the policy of a Presidential directive, instructing it to use its "emergency power when necessary" to effectuate delivery to war plants and agencies from "the lines of the lowest cost power."

Whatever may be said as to the equity, or lack of equity, in thus requiring an established utility to use its facilities to introduce a competitor into territory where it has an exclusive franchise to serve, I turn away from this rather surprising development under a seemingly innocuous provision in the Federal Power Act, with the remark that things are not always what they seem.

Condenser Deaerates Trenton Channel Feed

RALPH BRISCOE, Detroit Edison Company, Detroit, Mich.

TRENTON CHANNEL station is one of a relatively few large generating stations in this country using steel-tube economizers but not having deaerators in service. A closed feedwater system is used with condensed make-up and raw river water passed through an evaporator for vaporizing before being piped to the main condenser for condensation and deaeration. This unique use of large condensers as deaerators for eliminating gases from boiler feedwater before it enters the boiler has been the practice at Detroit Edison's Trenton Channel plant for a number of years and is operating at present with entrained oxygen held to practically 0.00 c.c. per liter continuously.

First requirement is that there be a pump or a combination of pumps to take water from the condenser and feed it through the stage heaters and boiler feed pumps to supply the boilers. It is necessary at the same time, however, to provide means of diverting a part of the water to storage if demand by the boilers is a minimum and do this without disturbing the boiler feed pump pressure and flow.

Condensate from the hotwell of the condenser is drawn off through a 16-in. hotwell pump suction line to a set consisting of two pumps on one shaft operated by a single motor. (To vary the intake pressure of the boiler feed pumps it is only necessary to vary the speed of this pump-drive motor.) A take-off at "G" is installed in the discharge of the hotwell pumps, before it enters the three feedwater heaters. A constant pressure control valve is installed in this take-off in order to hold constant pressure through the heaters and the boiler feed pump suction. Should water in the condenser hotwell increase in height due to lack of demand by the boilers, a high-water float control valve, "E," opens a valve, "F," in the take-off from the hotwell pump discharge. Excess water is then passed to a set of storage tanks by way of pipe "C" and the condensate header.

But if the demand of the boiler is greater than that supplied by the main condenser alone the deficiency must be made up to maintain equilibrium. Under this condition the water level in the condenser hotwell drops. This causes the low-float control valve, "A," to open a valve, "B," in the line "C" from the storage tank to the condenser. Water from the tank then passes to the condenser for deaeration and thence through the feedwater heaters and boiler feed pumps to the boiler drums.

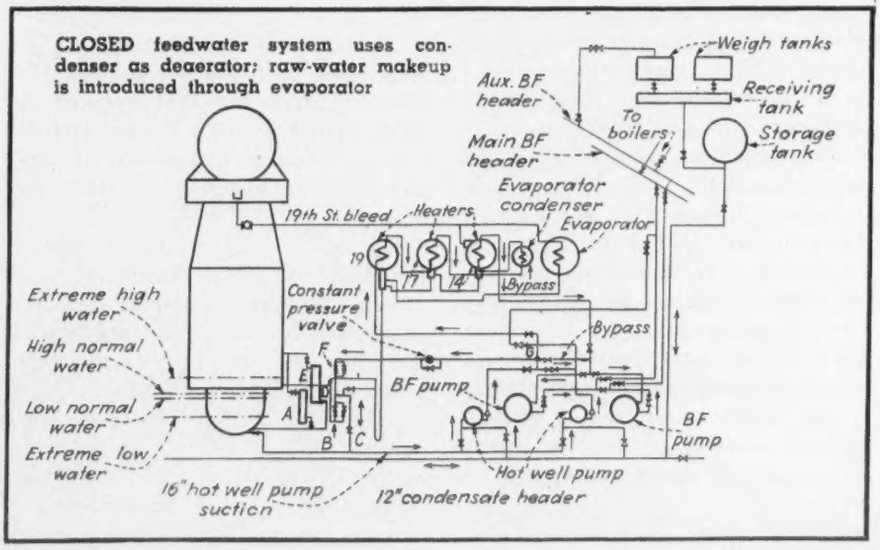
For best results water from the storage tank should enter the condenser for deaeration and be properly heated and distributed in the correct locations. To equalize flow to and from the condenser and to the storage tank a common header in the condenser room connects all condensers and storage tanks. By judicious adjustment of float-control valves practically an equal quantity of water can be discharged to each condenser for deaeration or to the storage tanks by each hotwell pump.

In such a system as this the low-float control valve will be open a greater percentage of the time than the high float, inasmuch as all condensate except that from heaters is pumped directly to the storage tanks through the header in the condenser room. It later finds its way back into the condenser through the low-float control valve for deaeration before passing via the heaters and boiler feed pumps to the main and auxiliary boiler feed headers.

It is of extreme importance how and where feedwater from the storage tanks is introduced into the condenser if proper deaeration is to result. It should enter the condenser as a finely divided spray and in a low-temperature zone as near as practicable to the outlet of the air ejector and where the make-up water will mix with the condensed steam. A long path of travel to the hotwell is desirable.

Three Heaters and Evaporator

Turbines at this plant have three heaters and an evaporator on each machine. Condensate from each is flashed in the one of lower pressure and passes eventually through a U-tube, acting as a seal, to the condenser for deaeration. However, it has been found that when the condensate has reached the lowest stage heater, it is sufficiently devoid of oxygen that a small auxiliary pump is used to pump it directly into the suction side of the boiler feed pump and thereby save heat. The lowest stage heater is now used to deaerate drips and condensates from other sources in the heating system and elsewhere.



Cables—How to Make Them Last—II*

How to inspect and maintain all types and kinds of power supply cables in industrial plants in both stationary installation and portable use — Avoidance and correction of harmful conditions and practices

R. B. McKINLEY and L. D. MADSEN, Cable Division, General Electric Co., Schenectady, N. Y.

THE IMPORTANCE of periodic inspection and maintenance of cable circuits cannot be overemphasized. If inspection and maintenance have been neglected in the past, a thorough check of all cable, including notations of all instances of poor maintenance, should be made and then all the discovered faults should be systematically eliminated. After the original inspection and correction of faults, checks need be made regularly only once or twice a year thereafter, also when load increases occur.

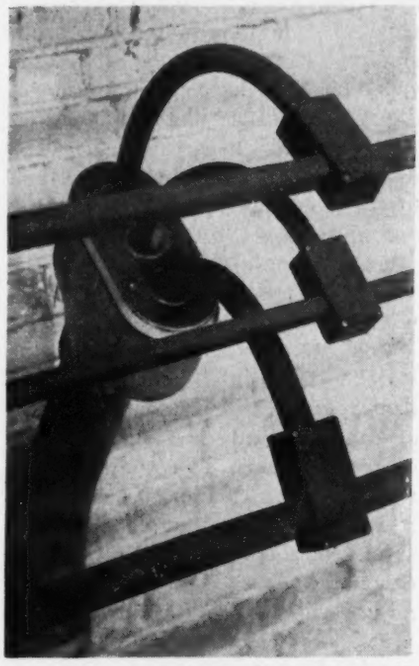
Protection from Mechanical Damage

Mechanical damage results every year in a great many cable failures that could have been prevented. It is not possible to protect every foot of cable, but there are many danger spots where trouble is almost certain some time unless precautions are taken.

Protection should be provided for cables in racks in exposed places where damage is likely to result from moving machinery or from material piled against them, as in a stockroom. Cables which cross over runways should be high enough for adequate clearance to passing trucks.

The report of fires of electrical origin during the years 1934 to 1938 includes 518 caused by accidents or acts of nature. Of this total, the largest number, 159, was due to mechanical injury to cables. The unrecorded cases in which the cables were damaged but no fires resulted are undoubtedly many times that number.

The point where cables leave a conduit is always a potential source of trouble. A report to the A.I.E.E. in Boston indicated that wiring is responsible for 25 percent of the electrical fires and that a common danger point is where the conductors bear on bushings at the ends of conduit lines, in cabinets, or in junction boxes.



ABRASION OF CABLE and resulting danger of fire are avoided by use of an insulated bushing at the conduit end; note the insulated connectors replacing taped splices

Conduit should be run as close as practicable to the terminals to avoid too much exposed cable, but not close enough to make sharp bends in the cable necessary to connect to the terminals. Cables should be brought out as nearly in the center of the conduit as possible without touching the edges. They should be fanned out without sharp bends. Sharp bending crushes the insulation, thus increasing the possibility of failure. Protection at the end of the conduit in addition to the bushing required by the Code may be provided by wrapping the cable with friction tape.

The edge of the casing frequently damages a borehole cable by movement of the cable due to load changes. Some companies have protected the cable at this point by means of a sponge rubber pad. This protection could also be provided by wrapping the cable at the edge of the casing with a piece of leather belting or similar material.

Wherever cables are swung close to a beam or other building member they should be protected by fiber sleeves or by heavy application of tape at the points where rubbing is likely to occur.

Workmen should be cautioned not to hang tools and clothing on cable circuits while working near by. In many cases it will be advisable to have an electrician present when construction work is being carried on near cable circuits to insure that proper precautions are taken to protect the cables from mechanical damage.

Cables buried directly in the earth are frequently damaged by workmen digging in the earth and striking the cable with a pick or shovel. Many plants protect their buried cables by first covering them with 3 to 12 in. of sand or pulverized soil and then covering the run with a plank or concrete slab. This quite effectively prevents accidental damage by workmen. If the cable run is not protected in this manner the location of the run should be well marked to reduce the possibility of damage.

Cables which run along the floor of a mine are vulnerable to damage

*See page 54, "Electrical World," May 15 1943, for first installment.

by falling rocks and tools, by runaway cars, etc. Therefore, such cables should be buried in the floor or hung overhead.

One of the common causes of failure of cables in a duct bank is damage to the lead sheath due to rubbing during periods of changing load, during which the cables expand and contract. This damage occurs most frequently at the duct mouth and at the supports in the manhole. Rubbing on the manhole supports can be minimized by supporting the cables on sliding porcelain saddles. Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point. Rubbing is a function of size of cable and length of run. In the case of runs of 400 ft. or more the cables may move more than 1 in. over the temperature range normally encountered. Large cables with wide load swings may move several inches daily.

Aerial cables which are suspended from messengers by rings are subject to damage by ring cutting. It is known that much of this trouble occurs in the first three rings on each side of the pole or support. The rate of cutting is dependent, among other things, upon the exposure of the cable to wind.

Telephone company experience indicates that ring cutting takes place at 80 to 90 percent of the poles. The length of time required for cutting to become serious will depend on the size of cable and degree of exposure.

It frequently occurs that after a messenger ring has cut partly through the sheath a crack will result, causing the cable to fail. That is, most failures are a combination of cutting and cracking rather than cutting alone. Since cutting is a cumulative process, ultimate failure can be delayed by moving the rings to new locations when the cutting has progressed to a dangerous point. Another and more satisfactory method is to replace the messenger rings near the pole with cable clips. If the clips are properly installed cutting will be almost entirely eliminated. Marlin ties will also eliminate cutting, but they are costly to install and last a relatively short time. Cutting is increased if the cable has a pull downhill. In this case grade clamps should be installed.

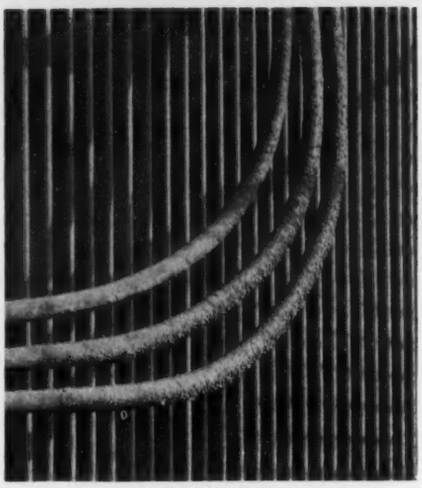
Braided aerial cables are subject to rotting away of the braid, which exposes the rubber insulation to the deteriorating effects of sunlight. Rotting is not limited to aerial cables, but occurs wherever a braided cable is exposed to weathering, such as vertical riser cables. Railroads have always maintained their braided cables by periodic painting. Paint which is oil- and waterproof, flexible and flame-resistant is available for this purpose.

Fireproofing Cable Circuits

Fireproofing of cables is good insurance because it frequently prevents fire in one cable spreading to others in the same group. Large groups of cables in racks, tunnels or in ducts should either be fireproofed or separated by fireproof barriers.

Fireproofing material can be obtained in tape form or as a cement mortar. These materials are well adapted for all applications except very long runs. In the latter case the use of barriers of some fireproof material may become advisable to prevent excessive costs of time or materials, and yet at the same time limit the amount of damage a fire in any one circuit can do.

Corrosion of lead sheaths underground can result from stray currents, dissimilar soil effects, galvanic action, differential aeration, or chemical attack. Any one of these can cause severe damage to a lead sheath in quite a short period of time and cable failure may result unless steps are taken in time to prevent further deterioration of the sheath.



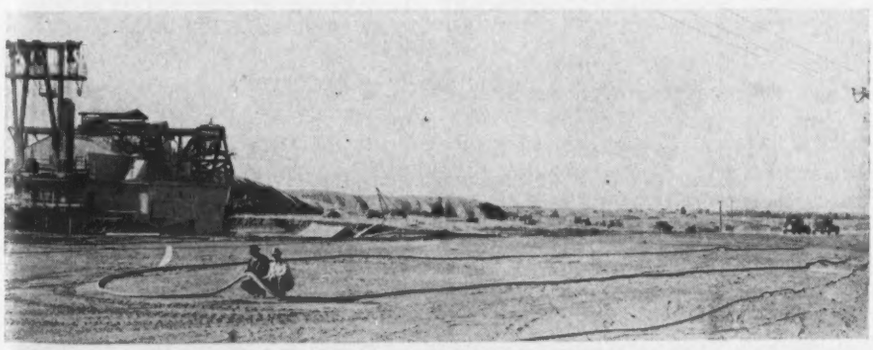
OIL AND GREASE, particularly harmful to rubber insulation, should not be allowed to collect on cables

The subject of corrosion from electrolysis is one which has been studied in great detail and much has been written discussing the causes and remedies. It is beyond the scope of this article to discuss this subject in detail. If corrosion of the sheath is noted, the local utility or the cable manufacturer should be consulted for suggestions as to the causes and remedies.

Organic acids from rotting wood, humus soil and sewage are particularly hard on lead sheaths. These acids can be removed by flushing or neutralized by ammonia gas. Another cause of chemical corrosion may be alkali from fresh concrete. For this reason a cement quite free of alkali should be used for fireproofing lead-covered cables.

Rubber-braided cables should be protected from the action of acids and oils. Although rubber insulation will successfully resist the action of most acids in the concentrations usually encountered, acetic acid has a particularly destructive effect. The braid is destroyed by acid attack within a short period of time and this leaves the insulation without protection and speeds its deterioration. Oil causes rubber insulations to swell, become soft and lose their insulating value.

Rubber-insulated cables which are



LOOPING PORTABLE CABLE on the ground results in maximum current capacity

exposed in racks should be protected where they are likely to encounter oil from overhead cranes or from rotating machines. Rubber cables in floor channels are subject to oil which may run over the floor and into the channels. If it is impossible to prevent the entrance of oil the cables should be racked in such a manner that the oil does not come in contact with them. Since oil in a cable channel or trench constitutes a definite fire hazard, it should not be permitted to accumulate.

Wiring of machine tools that use oils or cutting fluids should be protected as much as possible from these liquids. If such wiring as flexible loops to moving units must be exposed to oil, it should be painted with an oilproof paint and if it shows signs of wear it should be taped and painted.

Lightning Protection

Ranking second in the number of electrical fires caused by accidents or acts of nature is lightning. Cables connected to overhead lines should be protected by lightning arresters, and if the cable is shielded the shield should be tied to the lightning arrester grounds, as close to the arrester as practical. In this connection the adequate grounding of all metallic sheaths is strongly advised. Lightning arresters should be of the latest dependable type and of a size to limit the surge to a safe value. Lightning arrester grounds should be as short and of as low resistance as possible.

Corona

When single-conductor, braid-covered cables operating at 2,000 volts and above are pulled into ducts or conduit without proper shielding protection corona can result. Corona, and the ozone resulting from its generation, causes the rapid deterioration of rubber insulation and may damage varnished cambric insulation at higher voltages.

If the presence of corona can be detected by sight, sound or the smell of ozone, steps should be taken to remedy the situation. If corona is detected on a shielded or a leaded cable, see that the sheath or shield is properly grounded. If on a non-leaded or a non-shielded cable the best remedy is to remove the cable from the conduit and install it on insulators. If this cannot be done refer the details of the situation to the cable manufacturer for his suggestions.

Moisture

Although rubber insulated and leaded cables are satisfactory for use in wet locations, they should not be exposed to moisture unnecessarily. Low spots in conduit runs should be properly drained to prevent the accumulation of water. This is particularly important outdoors where this moisture is subject to freezing. When this happens the ice crushes the insulation and the cable must be repaired or replaced.

Terminations are particularly vulnerable to moisture, particularly those of multi-conductor cables. These terminations should be watched carefully and kept well taped and painted to prevent the entrance of moisture.

PORTABLE CABLES

As a general rule, portable cables have a much shorter service life than cables in stationary installation because they are subjected to much more mechanical abuse. Since the amount of rubber in these cables has been limited by the War Production Board, the cables of this type now being produced are not as tough and long-lived as those manufactured prior to April, 1942. This is an additional reason for making present cables last as long as possible.

Overloading Portable Cables

Overloads on portable cables are infrequent except in the cases of trailing cables on dredges, shovels and mining machines, where the cable is used when part of it is on a reel. Since each layer on the reel reduces the current-carrying capacity 15 or 20 percent, a cable which carries full rated load when strung out will be badly overheated if permitted to carry the same current with several layers on a reel.

There are instances when it is not feasible to string the cable out in long loops rather than coiling it in one spot or on a reel. This is particularly true in locations such as a mine, where space is limited. However, for a heavily loaded cable, this may be the only means of preventing cable destruction unless a larger size cable can be used. Trailing cables on dredges and shovels can, however, be laid out in long loops instead of coiled in one spot. In the case of a dredge cable it is best to loop the cable in the water rather than in the hot sun on shore.

Overloads can be limited in duration and magnitude by the correct application of fuses or circuit breakers. To protect a cable properly, however, the rather common practice of selecting a fuse or setting a circuit breaker to open on short circuit only will have to be altered and fuses or thermal relays chosen to open when the current reaches a point which will be dangerous to the cable.

Inspection and Maintenance

Although overloading causes damage to portable cables, most failures result from some mechanical damage. A cable which has been kinked, run over, stretched, struck by falling tools or rocks may not show any signs of damage, but the insulation will have been torn or crushed and eventually this weak spot will produce a failure.

The first step in a practical maintenance scheme for portable cable is to impress upon the operator of the equipment to which the cable is attached that what he has must be made to last for the duration, and that the life of a cable can be increased tremendously by a reasonable amount of care.

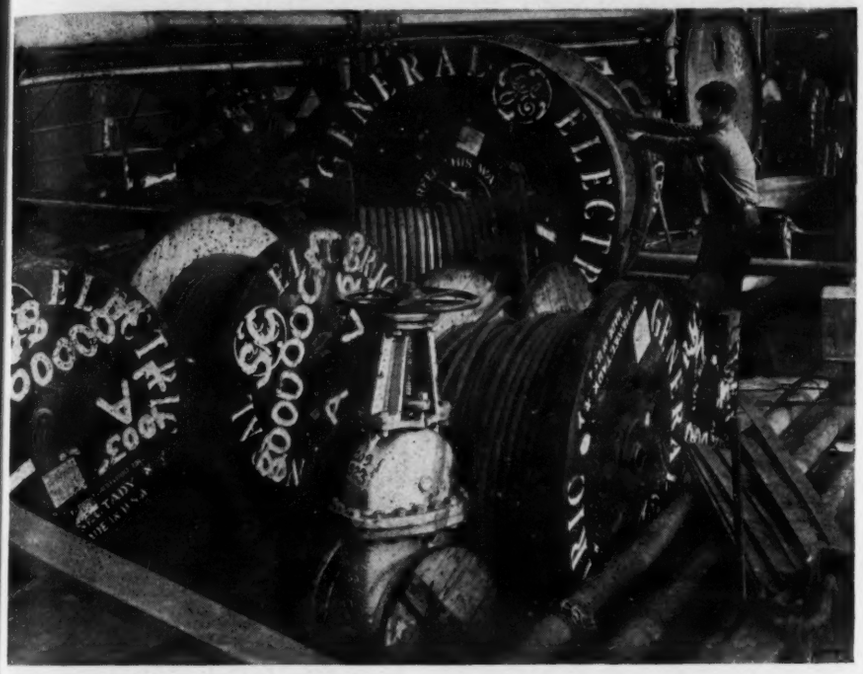
Next step is to set up a system of cable inspection similar to the system for maintaining other electrical equipment. Frequency of such inspection will depend entirely upon the amount and severity of service and upon what records indicate as to the frequency of failures.

Third step is to set up an efficient shop for prompt repair of those cables which have been damaged or have failed. It is important that these repairs be made in such a manner that the patch or splice will be as good as the rest of the cable. Splices which are made in haste or without the proper equipment will only fail again, causing additional loss of time and probably causing further damage to the cable.

One practice which causes practically the same damage as overloading is that of draping cords or cables of lights or portable tools over pipes carrying hot vapors or liquids. Since

the surface temperature of these pipes is usually high, the insulation and jacket will be hardened and will become a potential trouble spot. Another bad practice is coiling a cord and hanging it over a valve stem in a steam or hot water line.

Kinks are often straightened out by whipping or jerking the cable. Although whipping the kink out will usually result in less damage than straightening it by jerking, neither practice is beneficial and kinks should be straightened out carefully to prevent damage to the insulation.



WRONG WAY TO STORE CABLE—Note reels jammed together and heavy valve leaning against cable

Frequently cables are laid across a roadway or runway where they may be run over by passing trucks. Here again the damage to the cable sometimes is not obvious, but nevertheless internal damage will be sustained which will result in ultimate failure. If a cable cannot be run overhead across such a runway, it should be protected by planks on each side.

Heavy portable cable is frequently moved by attaching a rope to it and dragging it to a new location by means of a truck or tractor. This damages the cable because it is bent very sharply at the point of attachment. There are methods of moving that will do less harm to the cable. One, and the most satisfactory, is to fashion a semi-circular yoke to spread the stress over a greater area and eliminate sharp bends. The usual bending diameter recommended for rubber-jacketed cable is 12 to 16 times the diameter of the cable and for armored cables 24 times the diameter. If a larger yoke is available it should be used because the stress will be distributed over a greater length of the cable.

Permitting portable cables to come in contact with oily spots on the ground, floor or machine is inviting rapid deterioration of the cable jacket. This same precaution should apply for acids, since both oil and acid cause rubber to deteriorate. Cables should be carefully wiped after coming in contact with oil or grease to remove the excess.

Repairing Cable Failures

Proper repair of a cable failure is very important. Splicing of ordinary 600-volt rubber-insulated cable and wire is not a difficult task and every electrician is familiar with the proper procedure.

However, the splicing of cables for higher voltages, and of special construction such as armored or portable cables, requires special technique. Splicing instructions for the particular type or types should be obtained from the cable manufacturer so that they will be on hand when needed. The use of molding equipment for splicing rubber-jacketed portable cables is advisable. A mold, properly used, will make a vulcanized splice almost as good as the original cable.

Testing Cables

Testing cables in the field is frequently done with a megohmmeter, but this method does not always reveal the weak spots that may result in eventual failures. The results are inconsistent because of the presence of moisture, variations in temperature, and the cable not being in intimate contact with the conduit throughout the run. If a megohmmeter is used to test insulation resistance a guard ring should be employed to prevent incorrect results due to leakage over the cable surface.

If the cable is operating on an ungrounded system, it is possible that a high resistance ground fault may develop and not be apparent. On this type of system a ground detector should be applied to check for grounds.

As a means for reducing production delays from cable failures, a reel of portable or semi-portable cable could be kept on hand to bridge the fault temporarily while repairs are being made. This reserve cable can often be made up from salvaged lengths, placed on a reel and set aside for use only in emergencies.

Storage and Salvage

Cable should be stored in a cool, dry place on reels or in coils. Lagging should not be removed from a reel before necessary. If cable has to be stored outdoors, provision should be made to protect it from the weather as much as possible. Seal the ends to keep out moisture. Whenever cable is removed from a reel, the amount removed should be marked on the reel so that a record is at hand of what is left.

Many operators have for years carried out cable salvage programs, repairing cables which had failed, splicing together short lengths, repainting braided cables, etc. Companies that previously felt it would be uneconomical to splice lengths of cable shorter than 10 ft. are now splicing pieces of 3 to 4 ft.

All cable which can be salvaged for any future use is worth saving. A cable which has been used for underground work may be salvaged and used above ground on insulators.

PRIORITIES PROBLEMS

Project Owner Gets Rating

Case No. 61

In not every case in which a new project is to be constructed does the utility apply for the project rating. This rating must be obtained by the person, company or corporation which actually will own and operate the project on completion.

A utility which had been hired, as a contractor, to erect and equip an electrical installation for an industrial user, inquired of the Office of War Utilities whether it should apply for the project rating or whether the industrial user should do so. It asked further whether, if the project were given a rating, it could use inventory maintained under Order U-1 on the project, whether the project rating could be extended to replace any U-1 inventory used in the project and what it could do if, having used U-1 inventory, the project rating proved to be insufficiently high to replace the U-1 inventory quickly.

The utility was advised that the project rating had to be obtained by the ultimate owner and operator, in this case, the industrial user which contracted with the utility for the installation. As for using materials from an inventory maintained under U-1, this is permissible providing the project rating was AA-3 or better. Where U-1 materials are used to complete a rated project, they may be replaced under U-1 ratings provided that such use has reduced the U-1 inventory below the limits of Practical Working Minimum Inventory.

Certain materials controlled by Priorities Regulation No. 13, including principally copper wire, cable and busbar, and pipe of any kind, may be sold to the project on an AA-5 rating. Beyond these two cases, no material maintained under U-1, may be used on a rated project.

U-1 and L-41 Relationship

Case No. 62

In spite of some misunderstanding, there is no disparity between the provisions of Order U-1, which limits single-project plant additions to $500 worth of materials ($1,500 if it's underground) without specific authorization, and Order L-41, which restricts construction and remodelling to $1,000 in any calendar year. Utilities construction is not limited by L-41, except in the case of construction involving buildings.

A utility which planned several unrelated additions to capital wrote to OWU for a definition of its position under the two orders. It proposed three separate and distinct projects involving renovation to the building, which were to be carried out within the course of a calendar year, the first two of which were to total less than $500 for materials, the third to cost somewhat more than that figure.

The company was informed that it could proceed with the first without authorization, inasmuch as it met the dollar-value qualifications of both orders. The same held true for the second project, provided it was unrelated to the first. Had it been related to the first, the company would have been required to obtain special authorization from OWU, since the total project cost would have exceeded the $500 plant addition limit. For the third project, which was unrelated to either of the two previous jobs but involved the same structure and which was to cost slightly over $500, it was necessary to obtain special authorization both under U-1 and L-41. Special authorization was necessary under U-1 because the specific project material cost totaled more than $500. It was necessary under L-41 because the project cost, combined with the cost of the two previous projects, even though all three were unrelated, exceeded the $1,000 limit.

Thus it is obvious that the two orders provide different bases for calculating the allowable work. U-1 calculates allowable plant additions on the basis of separate and unrelated projects. L-41 calculates the allowable expenditures on a yearly total basis.

In applying for authorization to exceed the U-1 limit, a letter is sufficient. In applying for permission to exceed the L-41 limit, use form PD-200 or PD-200C, in most cases the latter.

Excess Inventory Sales

Case No. 63

Regional redistribution offices of the Office of War Utilities have a certain amount of latitude in the judgment they may exercise upon inter-utility sales of excess inventory. There are numerous factors on which these offices must base their decisions as to whether purchases shall be made from inventory or from a manufacturer.

One such case is that of a utility, designated Company A, which, having segregated excess inventory, listed its surplus with the proper regional office. Some time later, another regional utility was referred to Company A for the purchase of some transformers listed by A as surplus. The sale was consummated on the basis that A should hold the transformers for delivery some months hence so that the purchaser would

BLATEST AMENDMENT to Order U-1 provides a new certification which is to be placed upon orders for maintenance, repair and operational materials regardless of whether the order calls for controlled materials. The certification is to be signed manually or in the fashion provided for in Priorities Regulation No. 7. The new certification follows:

"Preference Rating AA-1, CMP Allotment Symbol MRO-U. The undersigned purchaser certifies, subject to the penalties of section 35(A) of the United States Criminal Code, to the seller and to the War Production Board, that, to the best of his knowledge and belief, the undersigned is authorized under applicable War Production Board regulations or orders to place this delivery order, to receive the item(s) ordered for the purpose for which ordered and to use any preference rating or allotment number or symbol which the undersigned has placed on this order."

The preference rating should not be used on purchase orders on a controlled materials producer (a metal mill), but both the AA-1 rating and the CMP symbol must be issued on orders for non-controlled materials.

not exceed his delivery quota for the current quarter. The purchase was large enough to wipe out A's surplus in the transmission and distribution control class.

Suddenly A was confronted with the need for some transformers of a different size and type than those it was holding earmarked for Company B. The question arose as to whether A could purchase the transformers it needed, either from a manufacturer or from the excess stocks of another utility while it still had transformers in its warehouse, even though the available units were earmarked for another company.

Company A was told that it could purchase the transformers it needed, being first required to clear through its regional redistribution office in an attempt to locate them in the excess stocks of another utility.

Had the transformers needed by Company A been the same size and type as those it was holding for Company B, A would probably have been instructed to use the earmarked equipment itself and B would have been given permission to buy elsewhere. This would have been based at least in part on the saving of transportation entailed in having Company A use material immediately available. Possibility of such a situation, however, is remote.

How to Request Increased Quotas

Utilities submitting applications for relief from the restrictions of Paragraph (f) of U-1 on inventories, withdrawals and deliveries fail in some cases to provide sufficient information to permit determination of the justification for the requested relief. Permission to exceed these restrictions should not be requested except when the circumstances are such as to make it impossible otherwise to safeguard the continuity of service. Because critical material shortages still continue no utility should request authority to maintain larger inventories or use larger quantities of materials than are absolutely necessary. Where circumstances are such that the utility finds it necessary to request relief from the restrictions of the order, the following information should be supplied.

1. *Inventory*—In requesting permission to establish specific practical working minimum inventories in excess of those permitted by U-1, one should state, by control class totals only, the dollar value of one's 1940 inventory, the inventory permitted by U-1, and the inventory required for one's present essential needs and explain the reasons why it is necessary to request higher inventory bases than are authorized by U-1. This explanation should cover the amount of plant for which one's inventory furnishes protection, the relationship of plant values and essential inventory, the amount of inventory classified as spare parts, the past turnover of inventory classes, and all other pertinent factors. This study should cover only major items of material and those which aggregate to relatively large amounts.

2. *Deliveries and Withdrawals for Maintenance, Repairs, and Operations*—If, because of unusually low use of materials in the last nine months of 1942 a utility considers it necessary to establish a higher base for deliveries and withdrawals under U-1, there should be stated in the request, by control class totals, the dollar value of the withdrawals in 1940, the withdrawal base as determined by U-1, and the base necessary for essential needs. State briefly reasons for requesting an increase in base. If it is necessary to exceed the withdrawal or delivery restrictions of U-1 for an unusual maintenance or repair job, a request should be submitted for permission to accept deliveries and make withdrawals during a specific calendar quarter, or quarters, stating by control class totals the normal delivery and withdrawal base, the dollar amount of deliveries and withdrawals necessary for the unusual job, that part of the unusual deliveries and withdrawals which can be absorbed in the normal bases, and the dollar amounts by which it is necessary to exceed normal deliveries and withdrawals. Producers should not request permission to exceed the delivery and withdrawal restrictions of U-1 simply because a maintenance or repair job is unusual or emergency. They should accomplish this work if at all possible within their normal delivery or withdrawal bases, and ask for permission to exceed by only the amounts necessary to meet their essential needs.

3. *Deliveries and Withdrawals for Extensions to Consumers Under U-1-c and U-1-d*—If it is not possible for a producer to make extensions authorized by U-1-c and U-1-d within the normal deliveries and withdrawals authorized by U-1, he should submit a request for permission to exceed the delivery and withdrawal restrictions of U-1 for a specific calendar quarter, or quarters, indicating by control class totals only, for each quarter, the normal delivery and withdrawal base, the estimated dollar value of withdrawals necessary to make such extensions, that part of the withdrawals which can be made within the normal authorization of U-1, and that part of the withdrawals which must be made in excess of the restrictions of U-1. He should also state that part of the necessary deliveries which can be made from his excess inventory and that part which must be purchased from other Producers or Suppliers. The producer should indicate briefly the number and type of consumers which are to be connected.

All deliveries and withdrawals which are authorized in excess of the restrictions of U-1 are to be considered as deliveries and withdrawals under U-1 and included in the producer's record of deliveries and withdrawals under U-1, including reports which are required from producers under U-1. Producers should indicate their records under U-1, and in filing quarterly reports when required by the War Production Board, all specific authorizations to exceed the restrictions of U-1.

RE DESPITE THE EXISTENCE of several orders affecting the availability of communications wire and other equipment, utilities which operate communications systems as an integral part of their power generating and distributing operation should obtain materials for the maintenance of such systems under Order U-1, basic order of the Office of War Utilities governing the operation of electric utilities.

Editorials

S. B. WILLIAMS, *Editor*

Has Public Sentiment Toward the Industry Changed?

ISOLATIONISM has no more place in business today than it has in government. For any industry to attempt to live apart on the theory that it is different is but to invite trouble.

For years the electric utilities have been conspicuous for the extent to which they have pursued a policy of isolationism not only with respect to other industries but with respect to each other. And during all that time they have been in trouble.

Of late, however, there has been a marked change in this attitude. Several co-operative activities have been started, not the least of which is the national advertising campaign. Many have also joined in the public education work of the National Association of Manufacturers.

Both of these activities are doing the industry good, but so much more could be accomplished if more utilities would acknowledge their mutual interdependence with each other and the rest of American business.

Unfortunately there have been several instances of late that have given utility managements a feeling that the worst is over and that the public is again rallying to their side. It is true that business men are becoming conscious of the trend of government participation in the utility business and seeing in that but the forerunner of similar infiltration in other businesses. There are also trends in the thinking of organized labor and in politics which are encouraging to private business.

These are all to the good, but nevertheless we have labeled them "unfortunate" because of the false hopes they are apt to arouse. While there are several indications of an improved sentiment toward private ownership, there is yet no indication of any marked change in public sentiment toward electric utilities.

Because a start has been made is all the more reason to get behind the movement to help the ball gain momentum. This means active co-operation with other businesses in helping the public to understand the advantages of a capitalistic economy for all business including the utilities. This is the first place where the utility industry must shed its isolationism.

But business cannot do all that needs to be done. It can go a long way toward establishing public acceptance of private business as a general principle. It can't undo the public thinking toward some one industry.

And here, then, is the second place for working together. For a decade or more the public has been told that government power has more advantages, not the least of which is low cost. For a decade or more the public has been told that private power has been milking them through a rapacious financial control. These things the public has been made to believe. For that reason it may accept capitalism for business generally, but not for utilities. And unless something is done about it this is exactly what will happen.

Collaboration with other businesses is a "must" of the first water. It is the quickest way to plow the ground for public dislike for government ownership. The other "must" is industry co-operation on a large scale to overcome special public misunderstanding.

A few brave souls are carrying the load for the industry at present. They need the support of all the others. They cannot win against isolationism within their own industry.

Power Contracts Renegotiation Exemption

WHERE does the War Department's latest ruling on renegotiation of power contracts leave the Federal Power Commission? In its official Procurement Regulations Memorandum contracts and sub-contracts with public utilities made at published rates "fixed, approved or subject to regulation by a public regulatory body," regardless of when made and whether or not they have a renegotiation clause, are exempt from renegotiation. Nothing could be more positive than this regulation.

Under the President's directive of last fall FPC is not only given authority but is instructed to renegotiate power contracts with government agencies or war contractors. The Supreme Court has ruled in the Pennsylvania milk case that, lacking definite War Department rulings to the contrary, the prices established by state regulation should rule for purchases made by the Army. The department has now given effect to this ruling by making its limitations a definite part of the procurement regulations.

It would seem from this that FPC is definitely estopped from entering renegotiation proceedings involving any power contract made with the War Department for service when rates have been approved, or are subject to approval by a state commission. If this action of the War Department governs, why isn't it an acceptable regulation for any other procurement branch of the government or for any war contractor, especially since the Supreme Court has upheld the authority of state bodies to regulate rates in such cases?

Semi-Annual Index Available on Request

Because of the necessity for conserving paper, the Semi-Annual Index of ELECTRICAL WORLD for the first half of 1943 will not be bound in the last issue in June, as has been our practice.

The Index, however, will be printed and will be sent to all subscribers who request a copy. It will greatly help us to estimate the number of copies to print and thereby insure maximum paper conservation if subscribers desiring a copy of the Index will notify us promptly.

Electricity Versus Gas for Post-War Residential Use

THE WOMEN of England in their post-war homes give electricity for cooking first choice and for room heating and water heating electricity is preferred to gas. These facts came out of a survey recently made by the Standing Joint Committee of the Working Women's Organizations.

Would a similar survey made in this country show anything like the same degree of preference for electricity over gas for cooking or water heating? Comparative usage to date is indicative probably of the answer we would get.

Public acceptance is a matter either of what people have been accustomed to or of promotion. People in cities are accustomed to gas, the appliances for which are constantly being improved in efficiency, while the promotion of electricity for cooking and water heating in most communities has not been overly aggressive. In many of our more densely populated areas this is due to the common ownership of both services.

Is it smart business for common ownership to soft-pedal electric cooking and water heating in gas areas? If electricity in the post-war era were promoted competitively with gas in these areas the companies might be surprised to see how rapidly such an electric load could be built. That might be tough on the gas department, but that isn't important in the long run. What is important is to serve the customer with what is up to date —what is wanted.

Imagine what would have happened if common ownership soft-pedalled electric light in a gas area. Far fetched? Perhaps. But let's not assume that gas for other residential services is more satisfactory in these areas. The public is much more capable of making its own decision, so why not let it decide.

Yes, but it is argued by combination properties, the customer can have electric cooking and water heating any time he wants it, nobody is going to stop him. That isn't giving the customer a fair break. Faint praise can be very damning.

The competition between gas and electricity for residential usage must be considered in making post-war plans.

No company can afford in the post-war era to have it said that the public in some other area is more modernly or efficiently or conveniently housed with respect to utility service.

Railroad Electrification Still Alive

ELECTRIFICATION of railroads was once assumed by some as limitless in scope—it would sweep all the trunk lines into its fold and puffing steam locomotives would retire to the branch lines to eke out a waning existence. That never happened, because there were numerous factors of finance, regulation and economics that held the conversions to a relatively small number of nevertheless sizable installations. Those installations were principally on the New Haven, Pennsylvania, New York Central, Virginian, Norfolk & Western and Milwaukee roads because they had metropolitan, commuter, heavy passenger traffic or heavy freight-grade conditions favoring them. Meanwhile there were electrifications on several suburban lines out of metropolitan centers.

Latest, of course, was the Pennsylvania extension to Harrisburg, and it is assumed that there will be a further extension to Pittsburgh when post-war conditions are favorable. Whether the New Haven or New York Central will go further seems dubious. The New Haven has gone in for a battery of diesel-electrics for the New Haven to Boston run; many western streamliners are diesels or diesel-electric; there is also the steam-motive turbine development, to say nothing of forward strides in reciprocating steam locomotives. The long-haul bus and the automobile have been potent deterrents, too.

All these counter-developments have created a feeling that steam-railroad electrification has run its course and there will be little more. That mood received a stirring jolt recently when the Long Island Railroad announced a determination to electrify 141 more miles over the next 20 years and spend a good part of $30,000,000 to that end. J. G. White Engineering Corporation made the study and the recommendations.

Railroad electrification apparently has by no means reached its maturity, and when the nation gets normal again and resumes its electrical pace perhaps more of the dormant projects may be dusted off and revived. Rubber and oil and transportation dollars are the factors to watch in anticipating the trend back to the most comfortable way to get from one place to another.

Washington Comment

R. N. LARKIN, Washington Staff

Two New Steps in CMP Evolution

THE moderate national defense program which antedated the fall of France saw a booming market for materials which got by on a "first-come-first served" basis. The more determined defense program which followed the fall of France saw the beginning of a priorities system, aimed at insuring that there would be sufficient steel for guns as well as for automobiles. Aid to England and other nations which now are our allies, plus the vast expansion of our own armed forces under the Selective Service Act, plus, finally, Lend-Lease, saw a continual inflation of the ratings available under our original priorities system, as more ratings were issued than could be honored. To combat this, PRP, the Production Requirements Plan, was established. Then, under the full impact of war, came the Controlled Materials Plan, and with it came the general feeling that the problem of materials control was essentially solved. That there would be modifications and local changes in CMP all agreed. It was felt, however, that if the nation was ever to reach a point at which it could expend most of its energies on production rather than on preparation, CMP must be "the last, not merely the latest," materials control scheme.

Component Scheduling

With CMP just about through its trial run and scheduled to become mandatory July 1, WPB has come up with two new devices, both of which represent further steps in the evolution of materials control. The more formal of these is the Component Scheduling Plan (ELECTRICAL WORLD, May 15, page 73), which will see to it that the supply of critical common components is geared precisely to the supply of scheduled end products. Considerably less formal, and currently less complete, is a preference rating system for facilities. This device is aimed at preventing the use, for relatively non-essential work, of facilities needed to meet a more essential, scheduled program.

The Component Scheduling Plan exists in fact, although as yet it has no directive in the sense that the Controlled Materials Plan has. Orders placed after June 1 for the components affected by the plan must go through the WPB industry divisions which handle such components. It will be the duty of these industry divisions to see that the component production schedules match up both in quantity and delivery dates with the production schedules of end products. A favorite explanation of CMP was based on the futility of allocating steel for fifty tanks unless rubber and steel for 100 tracks also was allocated. Applying this reasoning to CSP, it becomes immediately obvious that production of 50 internal combustion engines, which are controlled components, is merely a waste of time unless, at the proper point in their production, the manufacturer gets 50 crankshafts, which are sub-components.

The facilities preference rating scheme was hardly taken recognizable shape thus far, publicly at least. It has been announced merely that a system of preference ratings for use of facilities has been authorized, and that "appropriate administrative orders and directives" will be issued. For the present, at least, these "equipment priorities" will be confined to contracts calling for fabrication or processing rather than for delivery to an ultimate consumer, to contracts calling for use of equipment in essential construction not involving delivery of materials, and to contracts for use of facilities for repair and maintenance of plant or equipment of essential producers.

Any conceivable operation of this new priority system must be reasonably elastic. It is conceivable, for instance, that the supply of a given type of machine tool may be tremendously tight in one area, normal in many or all other areas. Certain tools or equipment may be tight as long as given programs bear great emphasis, but may be readily available if the given program is cut back, as was the tank program some months ago. Thus, application of "equipment priorities" may conceivably be by geographical areas of varying size and for varying periods of time.

Equipment Priorities

Centainly in its first stages "equipment priorities" will be a tool of CSP, for one of the devices by which balanced, scheduled production of components is to be achieved is by the distribution of component orders among producers. It follows that if components are sufficiently important that all facilities of all component producers must be used to make them, then a tool outside a producer's plant which could produce components if it were diverted from a less essential task can logically be assigned to component production. At this point enters the "equipment priorities" plan.

On a broader scale, this function will be carried out by WPB's new facilities requirements committee, which will have the privilege of consolidating production of scheduled products in certain plants and releasing facilities thus made available for other production.

Beyond a possible demand for more detailed bills of requirements, the immediate effects of these new devices on operating electric utilities will not, of course, be great. The plans are aimed at different levels of the war machine from that on which utilities are located. But they are of immediate interest to electrical manufacturers and they will be of more than academic interest to operating men as long as the list of covered components includes such items as turbines, motor-generator sets, boilers, steam condensers, switchgear, pumps, stokers, pulverizers and transformers. All these are controlled components, thus subject without qualification to the provisions of CSP, when purchased by a prime contractor or a claimant agency. Included in the list of sub-components are fuel injectors, electric motors and their controls, and generators.

A Guide to U-1

● Although U-1 is the basic wartime regulation governing the operations of electric, gas, water and steam-heating companies, its provisions need a simple translation especially for those utility employees not directly concerned with compliance, as well as executives responsible for keeping their company's operations within its requirements. Such a "trot" is provided in this guide to U-1.

Administered by the Office of War Utilities of the War Production Board, U-1, like all other wartime regulations governing industry, has as its primary purpose the halting of all operations which do not affirmatively contribute to winning the war. It has been written to allow the greatest possible latitude to utilities in the administration of their individual operations within the limits that it has been necessary to stake out to conserve the use of scarce materials.

The analysis which follows keeps to the arrangement of the order's provisions so it may be used as an interpretive reference paragraph by paragraph. At the same time an effort has been made to show the inter-relationship of the various parts of the order so that the reader can have the broad perspective necessary to a more complete understanding of the scope and purpose.

(a) Definitions

Paragraph (a) of Utilities Order U-1 is the dictionary section; it provides definitions for the terms which are used throughout the order. Some of these definitions differ from the normal meanings to which one may be accustomed so that, for an understanding of the order, it is essential to know what these words and phrases mean as they are used in the order.

An example is the word "producer." As used in Utilities Order U-1, producer is synonymous for utility. Every electric, gas, water or central steam heating utility in the United States, its territories and possessions is a producer—the word is used to conform to the lexicon of all other War Production Board orders. A company is a "producer" and subject to the restrictions of the order if it provides electricity (a) (1) (i), natural or manufactured gas (a) (1) (ii), water (a) (1) (iii), or steam heating (a) (1) (iv), directly or indirectly to the public, whether or not it uses the priorities ratings provided by the order. Only exception is water companies providing service exclusively for irrigation purposes.

Par. (a) (1)

A producer also can be a company which supplies any of these services for other than general use of the public, but only after a copy of the order has been specifically issued in the company's name upon application to the Office of War Utilities at Washington. Industrial plants, for instance, which generate their own power or produce their own gas, water, or steam heat may become producers under this order by applying for, and obtaining permission to come within its scope.

Par. (a) (1) (v)

A third category of producers are utilities in the Dominion of Canada to which a copy of the order has been specifically issued. In other words, Canadian utilities and industrial plants providing their own electric, gas, water or steam heating service are offered the use of the priorities provided in the order if they are willing to comply with the limitations and restrictions imposed upon public utilities in this country.

Par. (a) (2)

Definition of the word "material" as used in Utilities Order U-1 is all-inclusive. Material means all supplies and equipment of every sort, from paper clips to generators. It also means any piece of equipment in any stage of fabrication, or any part of the equipment—in short, all things.

Par. (a) (3)

Certain types of material are "controlled material." These include all the items listed in Schedule I of Controlled Materials Plan Regulation 1—specified forms and shapes of steel, copper, and aluminum.

Par. (a) (4)

The words "maintenance" and "repair" mean about what would normally be expected. Maintenance is the upkeep of property and equipment in sound working condition. Repair is the restoration of property and equipment to sound working condition after wear and tear, damage, or destruction of parts have made the property or equipment unfit or unsafe for service.

Par. (a) (5)&(6)

There are two definitions for "operating supplies." One covers the normal meaning of the phrase—material which is essential to the operation of property or equipment for supplying the utility services covered and which is generally carried in inventory and charged to operating expense accounts. This would include office supplies, fuel, water purification chemicals, etc.

Par. (a) (7) (i)

A second meaning of the term "operating supplies" covers another normal field of utility activity generally considered operations, but as used in U-1, it is specifically limited in its application. Operating supplies, as defined in this sub-paragraph include material for an addition to or expansion of property or equipment (including a minor extension of lines) in which the net cost of new materials does not exceed $1500 in the case of underground construction or $500 in the case of other construction. Only the cost of material is covered by these dollar limits, not the cost of labor or installation—but a job must not be split up into bits to get it under the wire.

Par. (a) (7) (ii)

The next paragraph is a limitation upon the application of the definition for "material" to maintenance, repairs and operating supplies—frequently referred to as MRO. Only material which is essential to minimum service standards may be used. A utility cannot improve its property or equipment by replacing material which is still usable with material of a better kind, quality or design beyond the limits of the sub-paragraph (a) (7) (ii) definition of operating supplies. In other words, if a piece of equipment is taken out which is still usuable or could be repaired and replace it with a new piece, that amounts to improving the property; if the net value of new material involved costs more than $500 (or $1500 for underground work) specific approval must first be secured from the Office of War Utilities.

Par. (a) (8)

A "supplier" is anyone with whom a purchase order or contract is placed for delivery of material to a utility or to another supplier. Utilities are sometimes suppliers, when they sell material to other utilities.

Par. (a) (9)

The Paragraph (f) restrictions of the order are stated in terms of "calendar quarterly periods." The calendar quarterly periods are the three month periods from January 1 through March 31, April 1 through June 30, July 1 through September 30 and October 1 through December 31. However, if one's customary accounting periods differ from these, one may continue to use three month quarters which are most nearly comparable.

Par. (a) (10)

"Inventory" includes all material, both new and salvaged, which is not physically incorporated in plant, without regard to how it is accounted for on utility books. There are two categories of material which are not inventory. One is appliances and merchandising supplies. The other is material which is separately accounted for and segregated for use on specifically authorized plant additions and expansions (construction work beyond the limits of "operating supplies" as defined in subparagraph (a) (7) (ii)). When any specifically authorized project is finished, however, any material left over becomes inventory.

Par. (a) (11)

"Construction" is another word for which the U-1 definition covers only specific territory not necessarily coinciding with the normal meaning of the word. Construction is any addition to or expansion of property or equipment having a dollar value of materials exceeding the $500 and $1500 limits of "operating supplies." In other words, anything built costing less than $500 or $1500 worth of materials is operations while anything costing more than that amount of materials is construction.

Par. (a) (12)

The definition for "class" is self descriptive. For the purposes of the restriction provisions of Paragraph (f) of the order, materials are divided into broad categories called "classes of materials." These classes are listed in Schedule A of the order.

Par. (a) (13)

"Short item" is defined as any special item of material —as distinguished from class of material—of which a utility has less than an estimated 90 day supply for use in maintenance, repair and operations. Paragraph (f) (5) outlines the procedure for obtaining supplies of short items.

Par. (a) (14)

(b) (c) (d) Preference Ratings, Restrictions on Use and How to Obtain Controlled Material

These three paragraphs should be considered together. Paragraph (b) assigns the priority ratings which utilities may use in obtaining materials, other than "controlled materials," for the maintenance, repair and operations work authorized by the order. Paragraph (c) specifies certain limitations upon the use of these ratings. Paragraph (d) assigns a CMP allotment symbol for the use of utilities in obtaining necessary "controlled materials" for MRO.

There are two priority ratings available to utilities. Each has a distinctly specified purpose.

For maintenance, repairs and operating supplies—MRO —utilities are authorized by Paragraph (b) (1) to use the rating AA-1, which is the highest rating in the scale except for the emergency AAA used only in cases of extreme urgency. The manner in which to apply the AA-1 rating to purchase orders for MRO materials is outlined in Paragraph (e) (1) (i).

Par. (b) (1)

For materials needed to construct transmission, switching and distribution facilities to serve either a war project or war equipment which have their own ratings, utilities are authorized to use the lowest rating assigned to the project or for delivery of the equipment. Before using this rating, however, authority must be obtained from the Office of War Utilities in the manner outlined in Paragraph (e) (2) of the order. This rating is applied in the manner provided in Paragraph (e) (l) (ii).

Par. (b) (2)

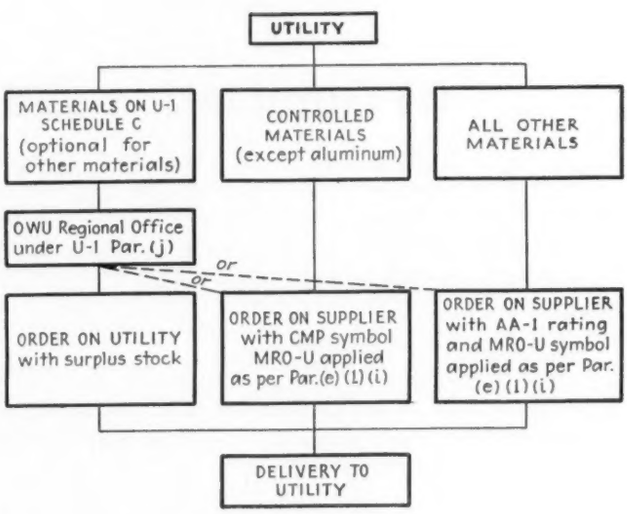

UTILITY
MATERIALS ON U-1 SCHEDULE C (optional for other materials)
CONTROLLED MATERIALS (except aluminum)
ALL OTHER MATERIALS
OWU Regional Office under U-1 Par. (j)
or
or
ORDER ON UTILITY with surplus stock
ORDER ON SUPPLIER with CMP symbol MRO-U applied as per Par. (e) (1) (i)
ORDER ON SUPPLIER with AA-1 rating and MRO-U symbol applied as per Par. (e) (1) (i)
DELIVERY TO UTILITY

FIG. 1—How to get MRO materials

Notice that the ratings assigned in this order apply only to MRO and to construction work to serve rated war projects and equipment. There is no assigned rating for any other type of utility construction; such projects must be individually authorized as provided for in Paragraph (h).

The purpose of Paragraph (c) is to prevent "gold plating" of utility properties through abuse of the priority

ratings to obtain better material than is actually required at the expense of other war activities. This paragraph also prohibits use of priority ratings except for materials which actually require ratings because supplies are short, thus minimizing the amount of interference with the channels of normal distribution.

Par. (c) (1)

Paragraph (c) (1) prohibits use of ratings to obtain scarce materials which could be eliminated without serious loss of efficiency by using a less critical material or by changing design. The prohibition is deliberately general in its terms; this is so that one can exercise prudent judgment in specific situations regarding the extent to which one can contribute to the war effort by using substitute materials.

Par. (c) (2)

In Paragraph (c) (2) use of ratings is prohibited for obtaining materials which can be obtained without ratings. Examples are such items as fuel, a great many office supplies, etc. If one isn't sure, a check with the supplier will determine whether it is necessary to use a rating to get delivery.

Par. (c) (3)

A third restriction applies to items listed in Schedule E of the order. Distribution of these items is governed unilaterally throughout all industry by the terms of other WPB orders. Utilities are not permitted to use U-1 ratings to obtain these items. Instead, the procedures of the applicable orders must be followed.

Par. (d) (1)

Paragraph (d) assigns the CMP allotment symbol MRO-U to utilities for use on their orders for MRO requirements of copper and steel items which are "controlled materials." This symbol is used instead of the priority rating assigned in Paragraph (b) to obtain these materials. The language of Paragraph (d) (2) is simply a technical provision which legalizes the MRO-U symbol and makes it the equivalent, under all Controlled Materials Plan regulations, of any authorized CMP allotment number or symbol.

Par. (d) (2)

Par. (d) (3)

Notice that the MRO-U symbol assigned in Paragraph (d) (1) applies only to copper and steel items of "controlled material." At present there is no provision in Utilities Order U-1 for allotting aluminum in controlled material forms to utilities for MRO. This is because of the extreme scarcity of the metal for any but direct military uses. There is, however, a procedure set up in Paragraph (d) (3) by which utilities may obtain essential quantities of aluminum in controlled material forms for construction of war service facilities of the type for which the Paragraph (b) (2) rating is assigned. For this purpose, aluminum may be obtained in one of three ways—on direct authorization from the Office of War Utilities in response to an application (d) (3) (i); in amounts up to 100 pounds per quarter as provided in CMP Regulation 5 (d) (3) (ii); by a priority rated order upon another utility which has the needed items in excess stocks (d) (3) (iii).

(e) Application and Extension of Ratings

There is outlined in Paragraph (e) the procedures which utilities must follow to obtain their needs of materials for MRO and for the construction of service facilities to war projects and equipment for which ratings are assigned in Paragraph (b) and from which a CMP symbol is assigned in Paragraph (d).

Before using the procedures given in this paragraph it would be well to be familiar with the provisions of Paragraph (j); this paragraph requires that certain alternative action be taken before placing orders for some materials, as will be noted in both Figures 1 and 2 illustrating the step-by-step procedure for acquiring materials.

Par. (e) (1) (i)

The certification which must be placed upon all rated utility orders for MRO materials is provided in sub-Paragraph (e) (1) (i). Simply place on each copy of a purchase order to the supplier the language printed in this section; it may be stamped, typed or written on the face, but the certification must be signed manually by the official responsible for the purchase and designated as the officer of the company to endorse priority certifications. Notice that on orders for "controlled materials" it is not necessary to put on the AA-1 preference rating, but on all non-controlled material orders it is required that both the rating and the MRO-U symbol be used.

Par. (e) (1) (ii)

The manner for endorsing the priority rating and CMP symbol assigned in Paragraphs (b) and (d) to obtain materials for construction of service facilities to rated war projects or equipment follows the procedure outlined in Priorities Regulation 3. The procedure is much the same except that a different certification is used. Before endorsing these orders, however, it is necessary to obtain approval from the Office of War Utilities for construction of the facilities by application in the form prescribed in Paragraph (e) (2). Also there must be indicated on all orders, whether they are for "controlled materials" or other items, the CMP allotment number assigned to the project in addition to the priority rating used. In other words, just as when applying the AA-1 rating for MRO materials both the rating and the utility CMP symbol are used, so both the priority rating and the CMP allotment number must be fixed on orders for

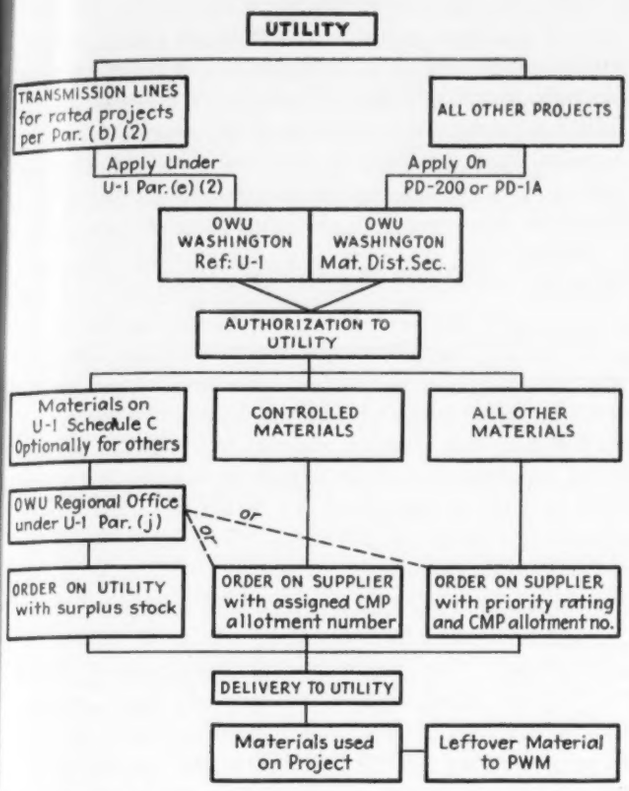

UTILITY
TRANSMISSION LINES for rated projects per Par. (b) (2)
ALL OTHER PROJECTS
Apply Under U-1 Par. (e) (2)
Apply On PD-200 or PD-1A
OWU WASHINGTON Ref: U-1
OWU WASHINGTON Mat. Dist. Sec.
AUTHORIZATION TO UTILITY
Materials on U-1 Schedule C Optionally for others
CONTROLLED MATERIALS
ALL OTHER MATERIALS
OWU Regional Office under U-1 Par. (j)
or
or
ORDER ON UTILITY with surplus stock
ORDER ON SUPPLIER with assigned CMP allotment number
ORDER ON SUPPLIER with priority rating and CMP allotment no.
DELIVERY TO UTILITY
Materials used on Project
Leftover Material to PWM

FIG. 2—How to get materials for construction

materials for these service projects. This is to permit WPB to trace the flow of materials and know what is being used with the copper, steel and aluminum allocated under the procedures of CMP.

Paragraph (e) (2) outlines the manner for applying to the Office of War Utilities for permission to use the priority rating assigned in Paragraph (b) (2), and lists the data required to support such an application. The application for permission to use the rating should be made in letter form and the information supplied should follow carefully the order prescribed in the sub sections of this paragraph. Most of the items of data called for are self explanatory. Be sure, under item (viii) to identify the materials that are to be taken from inventory and do not need to be replaced, as well as the materials to be secured from excess stocks of other utilities, any materials which can be had without priority assistance, and the materials for which the priority rating assigned in Paragraph (b) (2) or the CMP allotment number assigned in Paragraph (d) (3) are not needed. Be sure, also, in compiling the schedule of delivery of "controlled material" under item (ix) to exclude "controlled material" to be obtained from other utilities.

Par. (e) (2)

The remainder of this paragraph does not affect utilities directly. Paragraph (e) (3) authorizes a supplier who receives an order bearing a rating assigned by U-1 to extend that rating as necessary to obtain materials to fill the order in the manner outlined for such extensions in Priorities Regulation 3 and CMP Regulation 3. Paragraph (e) (4) is similar in purpose to Paragraph (d) (2)—it stipulates that orders carrying CMP allotment numbers or symbols issued under the terms of U-1 are to have the same status as any other rated CMP order under the CMP procedures.

Par. (e) (3)

Par. (e) (4)

(f) Deliveries, Inventory and Withdrawals

Paragraph (f) might be called the heart of Utilities Order U-1. This is the section which regulates, in accordance with wartime necessities, the flow of materials for utility maintenance, repair and operating supplies.

It has four principal functions: (1) establishes quotas for the amount of materials utilities may acquire for MRO; (2) fixes the size of inventories; (3) specifies the amount of materials which may be used to keep plant in working condition, and (4) provides exceptions from these specific standards which are applicable to emergency or special circumstances. Diagrammatically these functions fit together as shown in Figure 3.

All of the delivery, withdrawal and inventory restrictions of this paragraph are applicable to broad general classes of material rather than to specific items of material. The classes of material are listed in Schedule A of the order. Controls also are on a dollar-value basis rather than by specific amounts of materials. The purpose is to give the utility the widest practical latitude in selecting what is needed to keep a plant operating; perhaps last year a disproportionate amount of one kind or size of conductor was used and this year a disproportionate amount of any other type is needed. It's like point rationing—within the dollar-value limits for each of the eight classes of material in Schedule A the selection of items to purchase, stock or use belongs to the utility.

The quota for the amount of materials which may be acquired for MRO is set in Paragraph (f) (1) and must be calculated by each utility system, on the basis of its MRO activities in the last nine months of 1942. To calculate its quota, the utility determines for each class of materials listed in Schedule A the dollar value of materials which it used for MRO during the base period—the last nine months of 1942. (Don't include materials used for construction work authorized under other procedures such as paragraph (e) (2) and Order P-19). One third of that dollar figure is the dollar value of new materials in each

Par. (f) (1)

class which it may acquire during any quarterly period now. (See Paragraph (f)(4)(i) below for exception covering production department materials.) Notice that this quota applies to all materials acquired for maintenance, repairs or operating supplies, whether or not the utility uses priority ratings or CMP allotment numbers to get them.

Par. (f) (2)

The maximum size of inventories which utilities may have of MRO materials is prescribed in Paragraph (f)(2). The general rule is that utilities must not have in stock, in any class of material in Schedule A, more than a "practical working minimum"—usually referred to as PWM. Precise definitions of what constitutes the maximum amount which can be called PWM are given in the subparagraphs of this section, but it is expected that many utilities will not need all of the allowance for every category of material. A utility may determine the size of its inventory which fits the needs of its property, within the maximums established. Having made this determination, it may not accept delivery of materials—whether rated or not if its acceptance would increase stocks above PWM.

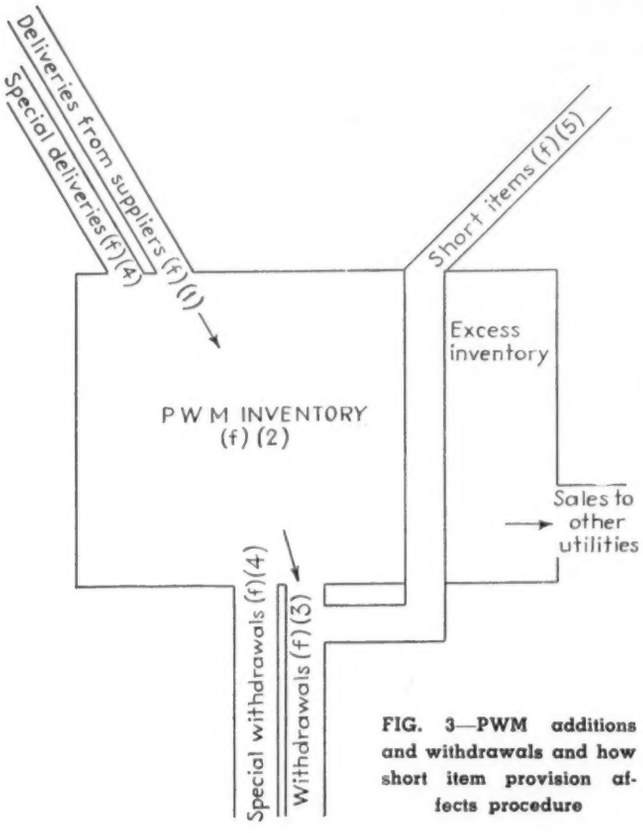


FIG. 3—PWM additions and withdrawals and how short item provision affects procedure

There are four formulas for computing the maximum PWM, each applying to different classes of material. These are illustrated in Figure 4. In earlier versions of this order—then called Order P-46—PWM for all classes of material was calculated by the same formula—a percentage of the inventory which companies had in prewar 1940. Since wartime operations have affected utility systems differently and since scarcity of materials has increased, it has been impossible to maintain this ideal of a single standard. The four formulas now provided retain a relatively liberal standard for classes of material used for MRO in production operations, where expensive spare parts must often be kept on hand for emergencies and activity is greater. On the other hand, PWM for such materials as office supplies, distribution lines, etc., has been reduced.

Par. (f) (2) (i)

Maximum PWM for transmission and distribution materials, meters and house regulators is roughly a year's stock at the rate at which utilities have been using such material for MRO under wartime conditions. To calculate one's PWM in this class of material, refer to the dollar value of withdrawals in this category during the last nine months of 1942, as computed for determining the paragraph (f)(1) quota of deliveries. Maximum PWM is four-thirds of this figure.

Par. (f) (2) (ii)

Most difficult to state of all the PWM formulas is the one for calculating maximum inventory for the production department—MRO materials for source of supply, reservoirs, elevated and pressure tanks, pumping and booster stations, generating stations and production and pumping stations. Loosely stated, PWM in this category is the 1940 inventory plus an amount equal to the percentage of increased system output since that time.

This is calculated quarterly, by adding to the dollar value of inventory at the latest inventory taken in 1940 the percentage of increased output in the 12 months immediately preceding the current quarter over the output in 1940. For example: To calculate the maximum PWM in this category for the second quarter of 1943, determine the percentage of increased output on the system in the year ending Mar. 31, 1943, over the output in calendar 1940. Suppose the increase is 25 per cent, and that the 1940 inventory for MRO in the production department was $100,000. The maximum PWM for the second quarter of 1943, therefore, would be $125,000 worth of materials.

Par. (f) (2) (iii)

Simplest of the PWM formulas is the one applicable to MRO materials in the switching and substation class. Maximum PWM for these materials is the dollar value of MRO inventory on hand at the latest 1940 inventory taking. This is the same PWM standard which had been in effect in all previous versions of the order.

Par. (f) (2) (iv)

The fourth PWM formula is applicable to all other classes of MRO materials except fuel, etc., which are exempted from inventory restrictions by Paragraph (f)(7). The base is the same as that in formula No. 1, the dollar value of all withdrawals of materials of the same class for MRO in the last nine months of 1942. In this instance, however, the maximum PWM is two thirds of the base. Or, loosely speaking, a six months stock at the rate of use during recent months.

The amount of materials utilities may use for MRO is regulated in identical manner as the amount of materials they may acquire. Paragraph (f) (3) limits the dollar value of withdrawals from inventory in any quarterly period for MRO to one-third the withdrawals in the same class during the last nine months of 1942. In other words, maintenance, repair and operating supplies may be used at the same dollar value volume as a company has been

Par. (f) (3)

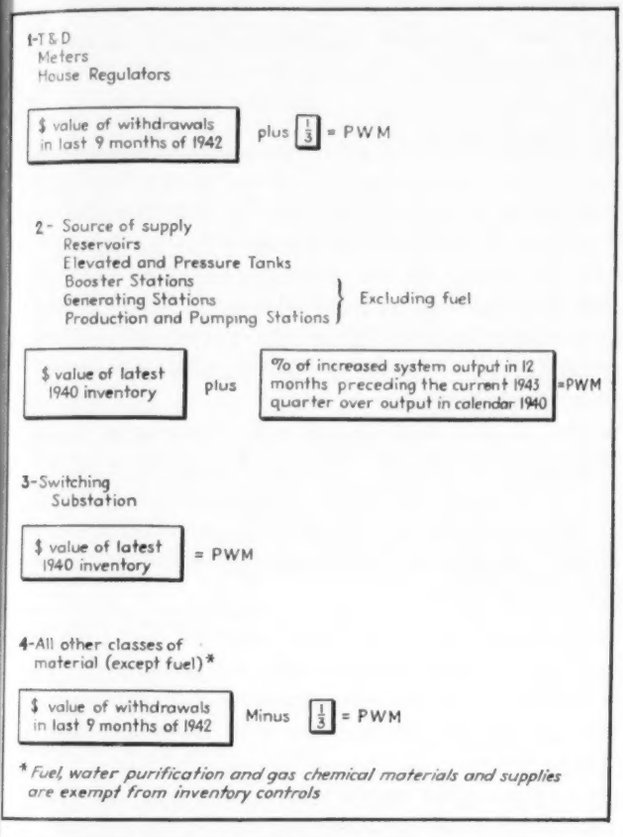

1-T & D
Meters
House Regulators
$ value of withdrawals in last 9 months of 1942
plus 1/3 = PWM
2- Source of supply
Reservoirs
Elevated and Pressure Tanks
Booster Stations
Generating Stations
Production and Pumping Stations
Excluding fuel
$ value of latest 1940 inventory
plus
% of increased system output in 12 months preceding the current 1943 quarter over output in calendar 1940
=PWM
3-Switching Substation
$ value of latest 1940 inventory
= PWM
4-All other classes of material (except fuel)*
$ value of withdrawals in last 9 months of 1942
Minus 1/3 = PWM
* Fuel, water purification and gas chemical materials and supplies are exempt from inventory controls

FIG. 4—PWM formulas for different classes of material

using them in recent months. (See Par. (f) (4) (i) for exception involving production department materials.)

As previously noted, Fig. 3 shows how these paragraphs are interrelated in their effect to regulate the normal flow of critical materials for utility MRO from scheduling of delivery to final use to keep the system operating. However, it will be readily apparent that the standards of Paragraphs (f) (1), (f) (2) and (f) (3), provide no room for emergency or special conditions. Without exception clauses in the order, utilities would be continually obliged to ask Washington for special permission to perform essential work beyond the limits established.

The purpose of Paragraph (f) (4)—represented by the smaller intake and outlet pipes on Fig. 3—is to meet this need for special clauses which may be automatically invoked by utilities when the occasion arises. Some of these exceptions provisions will be in almost daily use, as they modify the main standards for certain everyday operations. Others will be needed only infrequently.

First of these special provisions relaxes the quotas for acquisition and use of MRO materials as applied to the production department so that the quotas may increase automatically as system output increases, instead of being frozen to the 1942 level as prescribed in Paragraphs (f) (1) and (f) (3). Sub-paragraph (f) (4) (i), authorized utilities to schedule deliveries of materials and to withdraw MRO materials from inventory at the rate of the last nine months of 1942 plus the percentage of increase in output in the 12 months immediately preceding the current quarterly period over the output in calendar 1942.

Par. (f) (4) (i)

The formula for computing this expanding quota is the same as that for computing the PWM for production department materials with one exception—instead of comparing the 1943 operation with 1940, as in the case of PWM, the comparison is made with 1942. Thus, if $60,000 worth of materials for production department MRO were used in the last nine months of 1942 and the system output in the twelve months ending March 31, 1943, was 10 per cent above the system output in calendar 1942, the quota of deliveries and withdrawals for production department MRO in the second quarter of 1943 would be one-third of $60,000 or $20,000, plus 10 per cent, a total quota of $22,000.

Meters and house regulators also are provided special treatment which modifies the withdrawal quotas of Paragraph (f) (3)—but not the purchase quotas of Paragraph (f) (1). Effect of Sub-paragraph (f) (4) (ii) is to authorize withdrawal from inventory of enough meters to serve the net number of new customers and to continue the meter or regulator condemnation program followed during the last nine months of 1942. If 1200 meters were condemned or destroyed in that nine-month base period, the utility may condemn or destroy 400 each quarterly period now, replacing them from inventory—and may withdraw, in addition, the number needed for net new customers. Meters or regulators put into service to replace meters or regulators removed from service but not condemned don't count as withdrawals.

Par. (f) (4) (ii)

Next is the Act of God clause. Property that is damaged by acts of public enemy, sabotage, explosion, fire, flood, storm or similar climatic conditions may be repaired without regard to the limitations of delivery and withdrawal quotas. However, if after making the repairs it is found that more than quota had to be purchased or more material used than normally authorized, make a full report of the facts to the Director of War Utilities as quickly as possible.

Par. (f) (4) (iii)

Sub-paragraph (f) (4) (iv) is provided to help the utility which shortchanges its own inventory to help out another company. If material is sold from inventory to another company for an emergency and in so doing

Par. (f) (4) (iv)

one's own inventory is reduced below a practical working minimum, one may replace the material sold even though the purchase is in excess of the Paragraph (f)(1) delivery quota. The replacement allowed, however, is only the dollar value of the material sold, not necessarily the identical quantity.

Par. (f)(4)(v)

Sub-paragraph (f)(4)(v) is a sort of dividend provision. One may use from inventory, in excess of the Paragraph (f)(3) withdrawal quota, the dollar value of all usable material which is salvaged from plant during that same quarterly period. Thus, by removing, say, some dead line on the system which produces usable salvage material worth $1000, your MRO operations can be increased in that quarter by $1000 worth of material over your quota. It doesn't have to be the same material, but it does have to be the same class of material (Schedule A, again).

Par. (f)(4)(vi)

The last of these special provisions allows for seasonal variation in MRO operations. Sub-paragraph (f)(4)(vi) authorizes withdrawals of materials in any quarterly period in excess of the Paragraph (f)(3) quota so long as this excess is made up by withdrawing less than quota allowance in the other quarters of the calendar year. Notice that this exception applies only to withdrawals; it does not apply to scheduling deliveries because these must be kept flowing evenly and in balance with production if priorities are to work at all.

Par. (f)(5)

A great many utilities have unbalanced inventories which are "long" on some items of material and "short" on others. Frequently the value of the "long" items is such that the PWM for that class of material is exceeded, which means that under the terms of Paragraph (f)(2) no additional deliveries may be accepted, despite what may be an urgent need for another type of material in that same class. That's the reason for Paragraph (f)(5) which provides a means of procuring supplies of "short items" despite an inventory exceeding PWM.

Par. (f)(5)(i)

To qualify for acceptance of "short item" deliveries requires several very specific preliminary steps. The utility must segregate on its books all stocks of material in its possession which exceed PWM. This applies to all classes of material, not just the class in which you want a "short item" supply. The segregation must be complete in every way except physical separation of items. The excess inventory must be separately accounted for on the books (but it isn't necessary to have a duplicate set of stock records). It must be continuously held for sale to other utilities and war agencies authorized to buy it. It must be reported, item by item, to the proper regional office of the Office of War Utilities when this report is asked for on forms which are provided. Figure 3 illustrates how invoking the "short" item provision affects the procedure —a new source of supply is added which cuts off excess from PWM inventory. Note that the withdrawal outlet is not increased in size.

Par. (f)(5)(ii)

After having set up the required segregated accounting procedure for excess stocks, any subsequent transfer of that material to one's PWM inventory for use in maintenance or repair or as operating supplies must be counted as a delivery of material against one purchase quota as determined by Paragraph (f)(1). It must, in other words, come back into PWM through the regular "delivery intake" line.

Purpose of this whole Paragraph (f)(5) is to ferret out the items of already fabricated material held by utilities in excess of a practical working minimum and to make them available for redistribution to other systems which can put them into active use (See section on Paragraphs (j) and (k)).

Par. (f)(6)

Paragraph (f)(6) gives the Director of War Utilities authority to alter or suspend the restrictions on deliveries, withdrawals and inventory if the need arises in individual cases. He may do this on his own initiative or in response to an appeal from a utility, when convinced that the regulations work an unreasonable hardship or interfere with the war effort.

Par. (f)(7)

Paragraph (f)(7) is another special provision. It exempts from all quotas and inventory restrictions fuel, water purification material and gas chemical material and supplies. These, in other words, may be purchased, stored and used as freely as they are available and as they are needed.

(g) Controlled Material Inventory

Paragraph (g) may be considered the counterpart of Paragraph (f)(2). Paragraph (g) regulates the inventory of "controlled material" which utilities may have for construction jobs, just as Paragraph (f)(2) prescribes the inventory limits for all materials to be used for repair, maintenance and operations. However, it should be noted that Paragraph (g) applies only to controlled material. Utility inventories of other materials for construction jobs are not limited by general regulation except insofar as Priorities Regulation No. 1, basic regulation of all priorities operations, might apply.

Par. (g)(1)

Under Paragraph (g)(1) utilities are required to schedule their deliveries of controlled material of the types listed in Schedule B of the order so that at no time during construction will they have on hand more usable material of these types than is estimated can be put into the job during the forthcoming 60 days. This is the same in-

ventory limit that is prescribed in CMP Regulation 2, except that for utilities it applies only to the types of controlled material listed in Schedule B. Notice that the control in this case is on the physical volume of each type of material listed in Schedule B, not on the dollar value of a class of materials as in Paragraph (f)(2).

There are exemptions to this 60-day limitation to meet special circumstances. Paragraph (g)(2) specifies that utilities may accept deliveries of controlled material in excess of the Paragraph (g)(1) limit when such deliveries are made in accordance with Paragraph (c) of CMP Regulation 2. This paragraph of the regulation lists four circumstances under which "excess" deliveries of controlled material may be accepted. Three of them apply to situations where a delay in delivery would adversely affect the producer of the controlled materials; the fourth permits users of controlled materials to accept delivery of stated minimum quantities of certain items even though this quantity results in more than a 60-day supply. One should want to be familiar at first hand with the terms of this regulation—and other basic CMP regulations, as well—so detailed discussion is omitted here.

Par. (g)(2)

(h) Addition to Plant Restrictions

Paragraph (h) brings under regulation all construction work of utilities. It "freezes" utility property except as additions and expansions may be specifically authorized by one or another of the applicable procedures of the War Production Board. The purpose is to make sure that no scarce material is used to build new facilities or expand existing ones which do not contribute to the war effort; all industry is similarly regulated.

The first provision of Paragraph (h) prohibits construction of all additions to or expansion of utility property—including contract construction—except work that is specifically authorized by the War Production Board. There are a number of ways in which construction work may be authorized—one of them is the procedure previously outlined in Paragraph (e) of the order. Construction projects other than facilities to serve war plants and equipment covered by Paragraph (e) are most frequently authorized under Order P-19, WPB's overall project priority procedure for which a PD-200 application form is used.

Par. (h)(1)(i)

There are two other "blanket" authorizations in the sub-paragraphs of Paragraph (h)(1). Sub-paragraph (h)(1)(ii) permits utilities to construct line extensions to serve a new building where the foundation under the main part of the structure was completed prior to July 1, 1942, provided that the extension, including the service drop or pipe does not exceed 250 feet. In calculating the length, any portion built by the consumer must be counted.

Par. (h)(1)(ii)

Sub-paragraph (h)(1)(iii) dovetails with the definition in Paragraph (a)(7) which classifies as operations any construction job involving less than $1500 worth of materials for underground work or $500 worth of materials for work elsewhere. This type of small addition or expansion to property is authorized without specific approval—provided (1) that it doesn't involve an extension of lines to consumer premises or (2) improvement of property by replacement of property or equipment which is still usable with an installation of better kind, quality or design. In other words, a transformer or a compressor cannot be replaced with a better one just to get more efficient operation if the existing equipment is still usable; if the existing equipment is beyond use and can be replaced within the dollar limits for materials, this sub-paragraph authorizes the utility to go ahead. But don't subdivide a job into parts and do one portion at a time to get under the dollar limits!

Par. (h)(1)(iii)

There are also other blanket authorizations to utilities to make additions to or expand property under specified conditions. These circumstances are outlined in the various Supplemental Orders to Order U-1, which are discussed later in these pages.

Paragraph (h)(2) prohibits utilities from making a connection with a line built by a consumer or prospective consumer which, on the date of its completion, exceeded the restrictions of Order U-1 applicable to the same type of line built by utilities, unless specific approval to make the connection is first obtained. This provision is included to prevent circumvention of the order by a consumer who might build a line which the utility isn't allowed to build and then demand service.

Par. (h)(2)

(i) Sales from Inventory

Paragraph (i) establishes the ground rules for disposal by utilities of materials which they do not need or cannot use. This section completes the chain of controls over the flow of all materials at all levels. The distribution of new materials is regulated by various War Production Board procedures, such as priority ratings, CMP, etc. The amount of materials which utilities may use for their own property upkeep is regulated by Paragraph (f)(3) of the order. Paragraph (i) governs the disposition of other materials and equipment which

already have been fabricated and are in utility warehouses, to insure that these, too, will be put into a war job somewhere.

This section specifies the channels through which utilities may sell items from their inventory. It prohibits sale of any material from inventory except to the persons and for the purposes which are listed.

Par. (i) (1)

Paragraph (i) (1) authorizes utilities to sell anything which Priorities Regulation 13 of the War Production Board defines as "industrial material" in the manner prescribed by that regulation for "special sales," which are sales by someone who doesn't normally deal in the articles being sold. A "special sale" of an unrestricted industrial material may be made to anyone; a special sale of a restricted industrial material (as listed in the regulation) may be made only to those eligible to buy under the regulation.

In addition, Paragraph (i) (1) authorizes utilities to sell any industrial material as defined in Regulation 13 to any other utility to fill an order from that utility bearing a priority rating of AA-5 or higher. This is the authorization on which the great majority of transactions under the inventory redistribution program are made (see section headed Paragraphs j and k).

Par. (i) (2)

Under Paragraph (i) (2) utilities are authorized to sell materials which are not classified as industrial materials by Regulation 13 in any of these ways: (1) to fill an order with a priority rating of AA-3 or higher, (2) back to the supplier from which they were purchased, (3) to a scrap dealer as scrap, (4) to a used equipment dealer for resale, except items of equipment listed in Schedule D of the order, and (5) to the Army, Navy, Maritime Commission or a public housing authority for repair of an actual or threatened breakdown in utility services owned and operated by the agency.

Finally, under special circumstances, utilities may obtain specific authorization from the Office of War Utilities to sell material from inventory when none of the automatic channels of Paragraph (i) provide an outlet for such materials.

(j) (k) (l) (m) (n) (o) Placing Orders on and Refund to Sell for Inventory and Miscellaneous

Paragraphs (j) and (k) provide the mechanisms through which the utility industry's "share-your-inventory" program functions. This is a decentralized program, administered by the Office of War Utilities through 13 regional OWU Inventory Control offices strategically located throughout the country. These paragraphs put inventory sharing on a mandatory basis for those items of materials and equipment of which the supply is most critical to insure that everyone participates to the fullest extent possible in the interests of the war program.

Par. (j)

Paragraph (j) requires that all utilities first attempt to obtain supplies of $100 or more worth of any material listed in Schedule C of the order from the surplus stocks of already fabricated material in other utility warehouses before ordering from suppliers. A utility may negotiate directly with some other company for its needs or may inquire at the regional office for the name of a company which can supply what is needed. (See figures 1 and 2.) But, under the terms of this paragraph, an order may not be placed with a supplier for $100 or more worth of any Schedule C material without a statement from the regional office that the material needed is not reasonably available through the inventory redistribution program. The $100 limit applies, incidentally to individual items listed in Schedule C, not necessarily to the total order but it would of course be helpful to the war effort if this sharing program is utilized in every case.

Inquiries made to the regional office under Paragraph (j) should be in duplicate—one of which will be returned either with the name of the company from which the material may be obtained or a release permitting placing an order with a supplier. A letter or a regular price inquiry form is adequate. Telephone inquiries are sufficient if followed promptly by confirmation letters. Also, it may be mentioned that use of the regional offices need not be limited to materials on Schedule C—these offices have records of many items of other types of surplus equipment available for sale where they can be used.

Par. (k) (1)

Paragraph (k) provides the "teeth" which might be necessary to assure the operation of the inventory redistribution program. Under this section, a utility may be denied the right to use any or all priorities if it refuses to sell material in its inventory in excess of the Paragraph (f) (2) limits to any financially responsible company which is authorized to acquire the material and which makes a bona fide offer at not less than applicable price ceilings.

Par. (k) (2)

The same denial of use of priorities also may be applied by the Office of War Utilities if a utility refuses to sell material in its practical working minimum inventory when the material is required by another utility for repair of an actual breakdown of facilities or equipment.

Paragraphs (l), (m), (n) and (o) are the miscellany sections which are included in all priorities orders. This doesn't mean that they aren't important, simply that they apply to the mechanical operations of wartime regulation rather than the functional operation.

Par. (l)

Paragraph (l) deals with audits and reports. It requires that anyone applying or accepting a purchase order bearing a rating assigned under this order shall submit to an audit and inspection of his records by duly authorized representatives of the War Production Board. It also requires that utilities and suppliers must file such reports and fill out such questionnaires as may be requested from time to time.

Par. (m)

Paragraph (m) directs that all reports requested under Paragraph (l) and all communications concerning the order are to be addressed to: Office of War Utilities, War Production Board, Washington, D. C., Ref: U-1, unless otherwise directed.

All inquiries made under Paragraph (j) to regional offices of the Office of War Utilities are excepted from the provisions of Paragraph (m).

Par. (n)

Paragraph (n) is the assertion for legal notice that wilful violation of any provision in the order, wilful concealing of a material fact or wilful furnishing of false information to the Government is a crime subject to fine and imprisonment upon conviction. In addition, violators may be prohibited from further use of priorities and from delivering or processing material under control.

Par. (o)

Paragraph (o) asserts the applicability of all other War Production Board regulations to Utilities Order U-1 and all transactions affected by the order, except insofar as Order U-1 provides otherwise. In other words, the terms of Order U-1 are governing unless otherwise specified but the terms of other WPB regulations not in conflict with Order U-1 also are binding upon utilities. Restrictions of Paragraph (f) of CMP Regulation 5 are, however, specifically stated not to be applicable to utilities.

Supplementary Orders

There are five Supplementary Orders to Utilities Order U-1. Each of these gives blanket authority to utilities to build service extensions and connections to designated groups of prospective customers, notwithstanding the provision in Paragraph (h) of the basic order prohibiting construction of additions to or expansion of property without prior approval from the Office of War Utilities.

The purpose of these Supplementary Orders is to save both utilities and the War Production Board a large amount of paperwork and time in applying for and issuance of authorizations for extensions to certain types of customers for whom utility service is in the interest of the war effort.

It must be noted that these Supplementary Orders modify only the provisions of Paragraph (h); they do not modify the quota limitations of Paragraphs (f) (1) and (f) (3) nor the inventory limits of Paragraph (f) (2). In other words, materials required for extensions built under these orders count against your Paragraph (f) quotas just as material for maintenance, repairs and operations authorized in the basic order. The priority rating and the CMP symbol assigned in the basic order may be used to acquire any materials which must be purchased—but the requirements of Paragraph (j) for clearance from the Regional Inventory Control Office before purchasing materials listed on Schedule C applies equally to items purchased for these extensions.

Order U-1-a

Supplementary Order U-1-a permits the Army, Navy and Maritime Commission to get promptly and without red tape, utility connections for such facilities as defense patrol stations and the like which often must be erected in a hurry and frequently must be moved about. The order authorizes utilities to accept direct orders from these agencies for service which requires not more than 250 feet of additional line and not more than $1500 worth of materials in the case of underground work or $500 worth of materials for other types of work. When a service connection order of this kind is seceived, simply go ahead and build the necessary facilities without regard to Paragraph (h) of Utilities Order U-1. If the connection requires more line or material than authorized, however, permission must be secured before proceeding —a letter or telegram explaining the circumstances should get prompt clearance.

Order U-1-b

Supplementary Order U-1-b deals with connections to serve ranges. Purpose of this order is to allow utilities to provide service to families for home cooking where there is no other kitchen stove available or where the customer owns his own range. The order is so written, however, that customers are not entitled to either gas or electric range service if they can use a range using another fuel. It is also written to suspend for the duration of the war any competition between electric and gas companies for range connections.

The order provides that utilities may make service extensions to a dwelling (not a commercial establishment) in either of these situations: (1) the family wants service for a gas or electric range which was moved from their previous residence and there is no range provided with the new house, or (2) the house to be connected has no range of any kind and complete facilities are not installed for serving either a gas or an electric range; in other words an electric connection would be barred if gas facilities are already installed, and vice versa.

There is a further restriction covering the amount of material which may be used to make these connections, and this limitation applies whichever of the two previous situations is involved. For an electric range connection, not more than 15 pounds of copper in conductor may be used; for a gas range connection, not more than 170 pounds of steel pipe nor more than 75 feet of one and one quarter inch steel pipe.

Where it is desired and possible, other utility services, such as water heaters and lighting, may be served over the connections built within the provisions of this order.

Order U-1-c

Supplementary Order U-1-c has been nicknamed "the cow order"; it authorizes electric utilities to build extensions to permit operation of specified electric production appliances—water pumps for livestock, milking machines, milk coolers, incubators, brooders, feed grinders or milk sterilizers—where this will help increase food yields. There are a half dozen requirements which must be met in determining what rural lines may be built under this order, but the principal determination as to whether electrification of a farm will aid the food production program is the responsibility of the County War Boards of the U. S. Department of Agriculture.

To be eligible for service, a farmer must have one or more of the above listed appliances, be able to get them or have been assigned an AA-5 or higher priority rating with which to buy them. There must be no other means of operating the equipment on the premises. A farmer must also have livestock on hand which totals at least five "animal units" as determined by Schedule 1 of the order —utilities may construct 100 feet of line extension up to a maximum of 5000 feet, for each "animal unit" the farmer has. Certification of the number of "animal units" and the allowable length of line is made to the utility by the County War Boards.

Construction specifications for the extensions also must be followed by the utility. Primary lines must be single phase and conductor must be (1) No. 6 galvanized steel, (2) copper covered steel, No. 4 or No. 6 A.C.S.R. (but only to the extent these are available in excess utility inventories), or (3) any conductor having a conductivity equal to or less than No. 6 copper wire which is salvaged from plant after March 24, 1943. Secondary lines and services are limited to 30 pounds of non-ferrous metal per customer.

As in the case of Order U-1-b customers eligible to electrical service for food production under this order may also use the lines for other consumption such as home lighting, etc., where wiring either has been put in or can be obtained.

Order U-1-d

Supplementary Order U-1-d clears the way for utilities to provide electric, gas and water service, within certain limits, to new and remodeled houses and buildings where the construction is undertaken in accordance with WPB procedures covering buildings. This order replaces the former procedure which required that utilities apply for and obtain separate authorization for such extensions.

Service extensions which may be built under Order U-1-d without advance approval to the utility are prescribed in sub-paragraphs (a) covering industrial and commercial buildings and (b) covering residences. An industrial or commercial extension may be built under this order if the cost of materials required does not exceed $1500 for underground construction or $500 for other construction, and if the amount of materials does not exceed 60 pounds of copper in the case of electrical service or 250 pounds of iron or steel pipe in the case of either gas or water service. Residential connections may be built under this order if the materials involved do not exceed the $1500 or $500 cost limit and if the service to be supplied comes within the terms of the Housing Utilities Standards which specifies the maximum war-time limits for utility residential service.

Within these dollar and weight limits for materials utilities are authorized to extend service to any building where the construction work is carried out with specific War Production Board authorization to the builder. All that is necessary in such cases is that the utility write a letter addressed to the Office of War Utilities certifying that the extension is within the Order U-1-d limits and supply the letter to the contractor or housing agency which asks for it.

Records of all such extensions must be kept on one's books—by individual job identification.

Order U-1-e

Supplementary Order U-1-e applies only to water utilities—it sets up a procedure for providing water service to victory gardens. There are a number of conditions which must be met before a water company may lay a line under this order but where these are met the service may be installed without regard to the prohibition of additions to plant in Paragraph (h) of the basic order and without approval from Washington.

The conditions set forth are all self explanatory. No U-1-e victory garden extension may be more than 250 feet long, including any portion built by the consumer, and the garden to be served must be at least 5000 square feet—a plot, say 50 x 100 feet. Allowable length of extensions permitted is graduated in terms of the size of garden—not more than five feet of pipe may be laid for each 500 square feet of garden devoted to edible crops.

The garden must have no alternative source of water which would require less critical materials—a hose, for instance which could be connected to a nearby tap. Pipe used must be the smallest size practicable, never more than 1¼" in diameter. No enlargement of mains is permitted to provide service. No copper or copper base alloy tubing may be used in the extension.

Finally, all victory garden extension consumer must agree in writing before service is provided to abide by any water conservation rules which the company may impose, such as requiring watering only in off peak hours, etc.

NEWS OF THE WEEK

Minor Damage to Power Plants in Record Flood

Prompt action by utility companies throughout Middle West area affected by rising waters of Mississippi tributaries keeps equipment damage and service interruptions at minimum

The swollen Mississippi River, gorged by record flood waters on the Illinois, Wabash, Missouri and Arkansas Rivers, surged to its highest levels in 99 years early this week. Flood waters, fed by two weeks of almost daily rain, burst through weakened barriers in the six states of Illinois, Indiana, Missouri, Kansas, Arkansas and Oklahoma and, by Sunday, had spilled over 1,356,960 acres, causing $40,000,000 in crop damage and making more than 100,000 people homeless, according to the Red Cross.

Few Damaged

Although many of the Middle West's major generating stations were threatened by the rising water, prompt action by utility companies, with sandbags and pumps, saved all but a few from damage. As nearly as could be determined by Sunday, no serious power interruptions had occurred.

In Indiana floodwaters of the Fawn and Pigon rivers closed down three hydro-electric plants of the Northern Indiana Public Service Co. in the La Grange area. The utility switched to emergency lines from Goshen to maintain service.

The Wabash River at Terre Haute reached its highest levels since 1903. Officials of the Public Service Co. of Indiana reported that the flood waters had not affected Dresser station, south of the city. Little disruption of service had been caused, although areas around Terre Haute were almost completely inundated. Some services had to be cut, it was said, but not a great number. Two linemen of the Indiana company had a narrow escape when a boat in which they were working capsized. They managed to reach a tree and were rescued by life lines.

In Illinois, at Peoria, a spokesman for the Central Illinois Light Co. reported at 11 p. m. Saturday that the situation was well in hand. River stage was 28.51 feet and rising slowly, but at a decreasing rate. Highest previous crest at Peoria was 26.9 feet in 1884. The East Peoria generating station was not in danger. Some concern had been felt for the older Liberty Street station on the west bank of the Illinois. However, it was expected to come through satisfactorily unless conditions worsened suddenly. No loss of load had been experienced.

At Pekin, Ill., rising water threatened Powerton station of the Commonwealth Edison Co. Water seeped into the basement of the plant, but pumps kept it away from the turbines.

Aided by 270 soldiers who piled 25,000 sandbags on the generator deck

JEEP TO THE RESCUE—The Army's amphibian jeeps are playing a new role in the record 1943 floods which swept large sections of the Middle West last week. Here at the junction of highways 181 and 50, across the river from Vincennes, Ind., a crowd watches a jeep make its way along a flood-covered road

of the Osage power plant at Bagnell Dam, near Jefferson City, Mo., the Union Electric Co., serving St. Louis and vicinity, weathered last week's flood waters without serious difficulty.

OWU Man on Scene

William A. Lyons, chief of the Fuel and Allocations Branch of the Office of War Utilities, who spent several days on the scene to institute an emergency service curtailment plan if one were needed, expressed high praise for the company's handling of its operations during the danger period, adding: "I never saw a plant in operation under such adverse circumstances."

Principal difficulty experienced over the system was in capacity loss at the Osage hydro station and at the Keokuk plant, where flood waters overtaxed the tailgates and dropped output at the former plant from 165,000 kw. to 100,000 kw., and at the latter plant from 120,000 kw. to 90,000 kw. The loss was minimized when the load was cut down after several industrial plants were forced to stop operations because of flood conditions.

At the Osage plant water in the tailgate was 40 feet above normal. The gate, designed to pass 180,000 cu.ft. per second, passed 235,000 cu.ft. per second at the height of the flood. This flow, slightly under normal for the Niagara River at the falls, was 90,000 cu.ft. per second above maximum flow ever before handled at the tailgate.

While no curtailment program was needed, officials were apprehensive because a 75,000-kw. steam unit at the company's Cahokia plant in East St. Louis was off the line for maintenance.

At the company's Keokuk, Iowa, plant trouble in the form of a washed-out transmission line was narrowly averted when the Missouri River cut a new channel which passed just beside a tower which failed to collapse.

Lyons said the company had ready for operation an excellent emergency curtailment plan which would have relieved the situation, in the event of a major generating outage, until a broad curtailment plan, under Order L-94, could have been instituted. Since both the Osage and Keokuk plants continued in operation until the Cahokia steam unit got back on the line, no curtailment was needed.

Accompanying Lyons were Edwin Fleischmann, assistant Fuel and Allocations chief, and Miles Cary of the power supply section of OWU.

On the Arkansas River, near Muskogee, Okla., water outside the Riverbank plant of Oklahoma Gas & Electric Co. rose 9 inches above the turbine floor level. Sand-bagging and pumps kept the station interior free of water. Here the Arkansas River at crest was nearly six feet over any previous record, company officials said.

Water in the lake behind Grand River Dam was said to have reached 753 elevation, or some 8 feet above "normal."

Empire District Electric Co.'s 71,000-kw. Riverton, Kan., steam station and two hydro plants, with a capacity of 3,500 kw., flooded and closed down May 18 and 19. At Riverton there was two feet of water on the boiler room floor. Pumping started on the night of May 20 and by Saturday morning one 2,500-kw. unit was back in operation; by the morning of the 23d the 12,500-kw. unit was also functioning. Others were expected to follow soon. Lowell and Grandfather's Falls hydro was completely flooded. The company maintained full service to customers with the exception of power for the zinc mining industry, which did not resume operations until May 24. Suffering the greatest flood on record, considerable damage was done to hydro plant equipment and to abutments, according to C. D. McKee, vice-president.

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Wholesalers Award to J. M. Newton

The James H. McGraw Award Wholesalers Medal for 1942 was presented to John M. Newton, president of the Oakes Electrical Supply Co., Holyoke, Mass., "in recognition of his distinguished contribution to the advancement of the wholesaling branch of the electrical industry through his perseverance in securing recognition of the electrical wholesalers as contributing to national defense and the war effort," according to S. B. Williams, editor of ELECTRICAL WORLD and secretary of the committee of awards.

Presentation of the award was made on May 26 at the open session of the meeting of the National Electrical Wholesalers Association which was held in Buffalo.

The committee of judges awarding the medal to Mr. Newton comprised Walter J. Drury, Graybar Electric Co.; J. H. Fisher, Westinghouse Electric Supply Co.; L. E. Latham, E. B. Latham Co., and L. M. Nichols, General Electric Supply Co.

The previous four awards were made in 1939 to L. M. Nichols, in 1934 to Walter J. Drury, in 1930 to George E. Cullinan, vice-president of Graybar, and in 1927 to O. Fred Rost, at that time president of the Newark Electrical Supply Co. and, at present, editor of *Electrical Wholesaling*.

NEWS BRIEFS

ALABAMA POWER CO. have announced a "Production for Victory" contest, with 116 prizes totaling $1,010 in war bonds and stamps to stimulate boys and girls under 17 to volunteer their services (with pay) in the farm and city home to relieve the manpower and servant shortage. Merit points are awarded for hours worked at spraying, hoeing, weeding, grass-cutting, canning, cooking, cleaning, milking, building, repairing equipment and many other necessary chores, according to C. M. Kilian, advertising manager.

ABSENCE OF RAIN has dropped Eire's River Shannon to such a low level that the Electricity Supply Board has been forced to impose restrictions on the use of electricity. Steam generating stations in normal times would take up the slack but the coal shortage has curtailed their output.

SOME OF THE BIGGEST department stores in the country have given up their air conditioning systems in response to the government's plea for equipment to control temperatures in essential war plants. Already moved are 22 units with a total capacity of nearly 38,000 hp. Macy's, Gimbel's, James McCreary, Mandel Bros., J. L. Hudson and G. Fox (Hartford) are mentioned among others.

A "MANUAL OF INDUSTRIAL NUTRITION" has been issued recently by the Nutrition and Food Conservation Branch of the Food Distribution Administration, Washington, D. C. This is the first of a series of such pamphlets designed to protect the health of workers in war industries.

EIGHTEEN LATIN-AMERICAN ENGINEERS, in this country studying rural electrification, recently completed a 3,900 mile tour of the north central and eastern industrial sections. The tour was arranged by REA. Among plants visited were those of Allis-Chalmers, General Electric, Westinghouse, Copperweld, Anaconda, American Steel & Wire and Fairbanks Morse.

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Correction

In the May 8 issue of ELECTRICAL WORLD, page 10, a news story was headed "Mississippi Power Gets FPC Show Cause Order." The story should have referred to the Mississippi Power & Light Co., rather than the Mississippi Power Co.

Merger of All Federal Power Agencies Asked

New Office of Power Administration, sought in Dirksen bill, would combine government agencies dealing with generation, marketing, distribution, control and financing of power, and regulation of utilities

Based on his belief that "public power is here to stay," Rep. Everett M. Dirksen, Illinois Republican, has introduced legislation to combine under an Office of Power Administration all federal agencies dealing with the planning for, generation, marketing, distribution, control and financing of electric power, and with the regulation of electric utilities.

Cites Two Billion Investment

Dirksen told the House such legislation is necessary because the federal government, with a $2,000,000,000 investment in public power projects, is appropriating "something in excess of $300,000,000 yearly on power projects . . ." These funds, Dirksen pointed out, are made available to a multiplicity of agencies dealing with various phases of the power program, adding:

"The thing to do is to co-ordinate these activities wherever possible that we may more intelligently legislate and appropriate in this field."

Dirksen's bill (H.R. 2754, referred to the committee on interstate and foreign commerce), would:

1. Establish an independent Office of Power Administration under a Federal Power Administrator appointed by the President, subject to Senate confirmation, to a four-year term at $10,000 yearly. The administrator may have no connection with any electric utility, nor may he own stock in such company.

2. Consolidate the Bonneville Power Administration, Rural Electrification Administration, Tennessee Valley Authority and Federal Power Commission in the new office, transferring thereto all personnel and functions. Only exception would be to allow FPC to exercise independently its rate regulation, investigation and adjudication functions.

Power Loan Transfer

3. Transfer to the new agency all functions of the Reconstruction Finance Corporation and Defense Plant Corporation relating to power loans, all functions of the Securities and Exchange Commission relating to electric utility regulation, all functions of the Federal Works Agency relating to construction and operation of electric power projects, and all functions of the Bureau of Reclamation relating to the production and marketing of electric power.

4. Establish a Federal Power Advisory Committee composed of the Chief of Engineers, U. S. A., Commissioner of Reclamation, Bonneville Power Administrator, Rural Electrification Administrator, chairman of the Reconstruction Finance Corporation, Federal Works Administrator, chairman of the Federal Power Commission, chairman of the Securities and Exchange Commission and chairman of the Tennessee Valley Authority. The committee would be charged with development of "a co-ordinated national power policy in the interest of national defense as well as of peacetime needs."

5. Abolish the National Power Policy Committee and the Division of Power, both of the Interior Department, transferring their functions to the new agency.

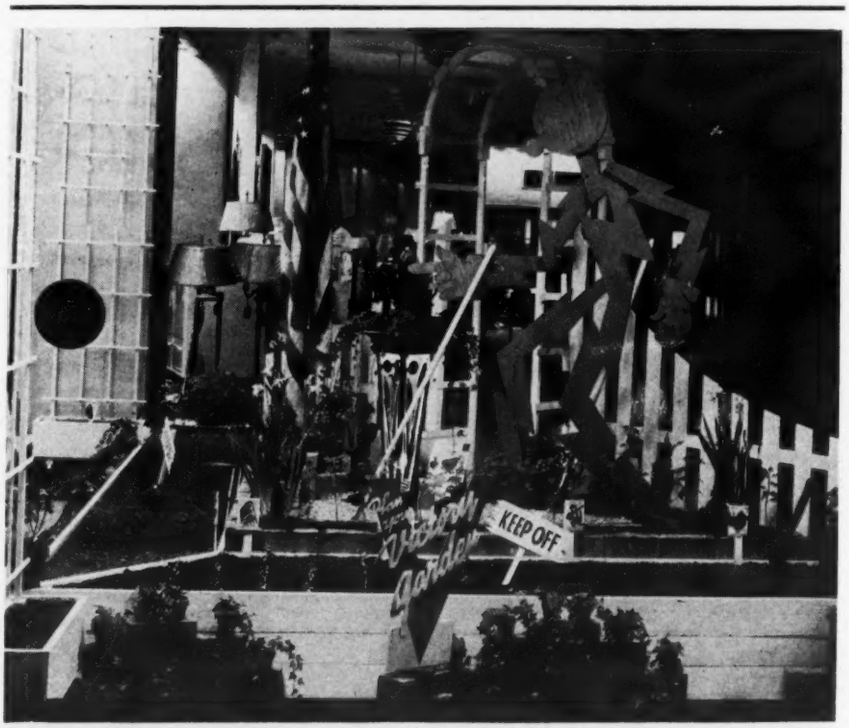
Advise on Power

6. Make it the duty of the advisory committee to advise other governmental agencies on power matters when requested to do so, and declare it in the public interest for the Office of Indian Affairs, the National Park Service, Army-Navy Munitions Board, Office of War Utilities and any other government agency concerned with electric power to consult with the new agency on power matters.

Would Transfer Funds

In addition, the Dirksen bill would transfer to the new agency all appropriations, funds or allotments to agencies consolidated into it, and as much of the unexpended balances now available to consolidate agencies as the Budget Director might direct.

Laws and regulations relating to any agency or function transferred to or consolidated with the Office of Power Administration would remain in full force as far as they are consistent with the Dirksen act. Court actions filed under these laws or regulations would not be affected.



REDDY KILOWATT VICTORY GARDEN—Onno Hinrichs, Toledo Edison Co. display manager, set up this miniature victory garden in the corner window of the company's downtown sales floor. The utility has appropriated $200 for prizes for these gardens and two groups have been organized to cultivate land owned by the company. Believe it or not, the vegetable plants in the window are actually growing! The bean crop grew 10 inches in as many days after planting.

KEEPING FARM EQUIPMENT WORKING—Harry Gilbert, commercial service supervisor of Niagara, Lockport & Ontario Power Co., trains youngsters at a district school to clean and oil motors as part of the company's program to keep farm electrical equipment in top operating condition during the war period. The utility has a three-fold service to farmers involving, repair, exchange and training clinics to help farmers faced with manpower and equipment shortages

Utility Taxes Up 88.7% For Quarter

Dividends Show 2.5% Drop, FPC Says

Total taxes charged to electric operations of the larger privately owned electric utilities in the United States in the first quarter of 1943 were reported to be $178,465,000, as compared to $164,132,000 in the first quarter of 1942, an increase of 8.7 percent, according to a statement issued today by the Federal Power Commission in its new quarterly series entitled "Statement of Taxes, Dividends, Salaries and Wages for Class A and Class B privately Owned Electric Utilities in the United States."

Total dividends for the first three months of 1943 amounted to $95,502,000 as compared with $97,956,000 in the same period of 1942, a decrease of 2.5 percent, the report shows, while salaries and wages in the first quarter of this year increased 0.6 percent to $117,213,000 from $116,569,000 in the first three months of 1942. The statement points out that in reporting salaries and wages charged to electric operations certain of the respondents include salaries and wages of other utility departments and others do not include charges to clearing accounts.

In the Federal tax bracket, excess profits taxes increased 74.1 percent to $53,656,000, income taxes were down 14.0 percent to $51,052,000 and other Federal taxes decreased 2.5 percent to $15,878,000, bringing the total Federal taxes for the first quarter to $120,586,000, an increase of 13.3 percent over the total of $106,427,000 in the first quarter of 1942. State and local taxes increased 0.3 percent to $57,879,000 over $57,705,000 in the first three months of 1942.

Dividends on preferred stock in the first quarter of 1943 were $31,482,000, or 10.1 percent over the $28,600,000 figure for 1942, and common stock dividends decreased 7.7 percent to $64,022,000 from the 1942 figure of $69,356,000.

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"Write-Ups" Charged Idaho Power by FPC

The Federal Power Commission has directed the Idaho Power Co. to make accounting adjustments involving the disposition of $11,603,081, representing $2,040,448 in excess cost of acquisitions over original cost and $9,562,632 in "write-ups" and other "erroneous charges" established by the company in the process of reclassifying its accounts and determining the original cost of its electric plant, according to a recent commission announcement.

The company's revised original cost studies showed the original cost of the Idaho Power's electric plant, as of January 1, 1937, to be $26,579,720, made up of $25,824,779 in Account 100.1 (electric plant in service) and $754,941 (construction work in progress). Thus the amount to be disposed of represents about 44 percent in excess of the original cost of Idaho's electric plant as reported by the company, not taking into account the amount of $706,165 in Account 100.6 (electric plant in process of reclassification) and alleged by the company to represent cost of plant applicable to Idaho's hydro-electric power plant at American Falls.

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Oil Savings Seen in Colloidal Fuel Use

Fuel oil savings up to one-third normal consumption could be obtained by substitution for oil of a colloidal fuel composed of 40 percent highly pulverized bituminous coal and 60 percent No. 6 (Bunker C) fuel oil, U. S. Bureau of Mines engineers have reported to Interior Secretary Harold L. Ickes.

Atlantic Refining Test

The report followed a one-month test by bureau engineers at the Philadelphia plant of the Atlantic Refining Co. The fuel was fed to the furnace through stream-atomizing burners. The test was performed by regular company personnel as part of regular plant routine with existing equipment.

No difficulties were encountered in burning the fuel, and the flame responded smoothly to changes in boiler load and variations in the amount of air. Troubles from ash in the furnaces were less than had been anticipated. More power was required to pump the colloidal fuel than would have been required to pump straight fuel oil, and, in general, pump capacities may be expected to be lower than rated when handling colloidal fuel. A certain amount of erosion in pumps and burners may be expected despite the consistency of the coal, most of which in the Philadelphia test was ground as fine as talcum powder. The mixture probably could not be used in domestic heating furnaces. The test showed, however, that this emergency fuel could be the practical solution for many individual cases where oil supply has been decreased.

"The amount of settling out of coal from the oil depends on several factors, such as the temperature to which the fuel is heated, the fineness of the coal and the movement of the fuel," bureau engineers reported. "Clogging of heaters, screens, meters and control valves must be watched. In general, none of these difficulties proved serious when operating routine was properly organized. No boiler shutdowns occurred from operating difficulties while using the colloidal fuel."

Charge Use of Dam for Power Helped Floods

Operation of Oklahoma's Grand River project to supply power to Ark-La co-op, instead of flood control, contributed to disastrous May floods, Lasley of Arkansas commission avers

Operation of the Grand River Dam project in Oklahoma to supply power to the REA-financed Ark-La Electric Co-operative, instead of for flood control, for which it was announcedly constructed, was responsible to some extent for the unprecedented flood in the Arkansas River valley May 10 to 17, P. A. Lasley, counsel for the Arkansas Department of Public Utilities, has charged in a letter on May 14 to Representative Brooks Hays of Arkansas.

735-Ft. Level Recommended

Pointing out that Army Engineers who designed the dam recommended that the power pool be kept no higher than 735 feet above sea level, Mr. Lasley said that on May 12 it was permitted to go to 751 feet.

Army engineers in Little Rock declined to comment on the situation, one member of that organization there saying the flood control capacity of the dam was "a highly controversial matter," and the Army engineers office did not want to become involved. He said, however, unofficially, that if the dam were under his jurisdiction it would be operated in a different manner.

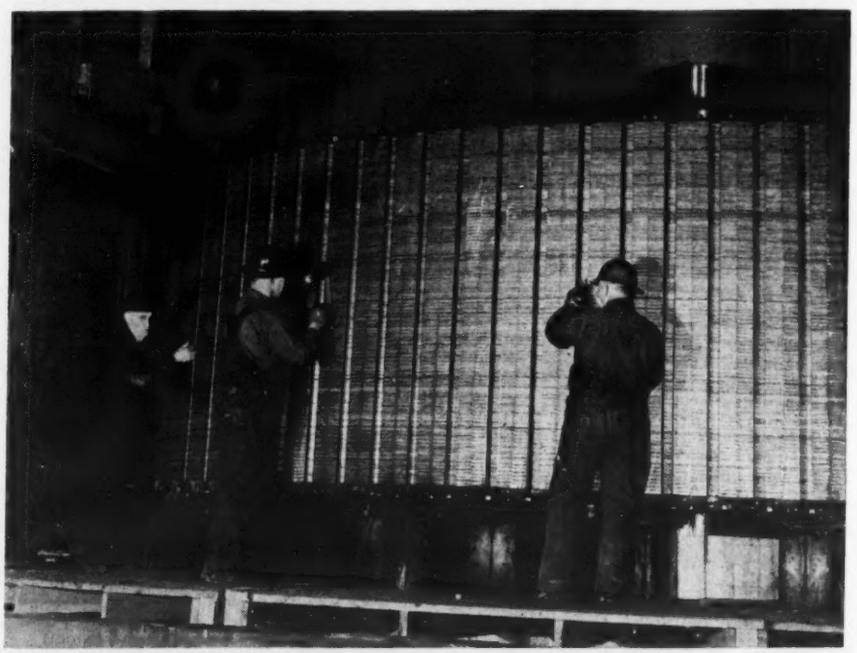
"Rain began falling in the watershed of the dam on May 7," Mr. Lasley wrote Mr. Hays, "and the last portion of the storm occurred May 8. At that time it appears that the elevation of the water in the dam was 9.7 feet above that at which it was designed to operate for power. The water has gone much higher than was expected and there has been the most disastrous flood in the Arkansas Valley in its history. Of course nobody can tell what would have happened had the water level in the reservoir been down to 735 feet when the flood occurred. That is the level at which it should be permitted to be operated and never permitted to exceed. Any time that the water level in the dam exceeds 735 feet it creates a menace in the valley. Not withstanding these general rains, this general area is still on the minus side of the rainfall average to the extent of nearly five inches. I am decidedly of the opinion that the water level in this dam should be held at 735 feet for power purposes."

Two days earlier Mr. Lasley had written Concressman Hays on the same subject. In his earlier letter he said: "I am in receipt of yours of the 8th (May 8) following up our previous conversations concerning the destruction of flood control capacity at the Pensacola (Grand River) dam for power purposes. In this letter you state that those in charge of the operation of the dam have been given positive instructions not to permit the flood control plans to be disturbed. These instructions either were given too late or not observed.

"There is now raging one of the worst floods in the history of the Arkansas Valley. Much of this water comes from above the Pensacola Dam. The river at Fort Smith (Ark.) is now 41.6 feet, 3½ feet higher than ever known. Between Little Rock, Ark., and Fort Smith 23 levees have gone out or will go out, thousands of acres of crops have been destroyed and the flood damage will run into millions of dollars. With food as critical as it is, a national tragedy has resulted from or been intensified by the manner in which this dam has been operated. Those in charge of the Pensacola Dam evidently have not followed instructions and increased the water level in the dam for power development. It was conclusively shown by evidence during the hearing held by the Federal Power Commission making an investigation of the Southwest Power Pool arrangements that the electrical energy secured through an increase in the water level of the dam was not needed to be generated at the dam because it could be actually supplied from other sources."

Recalls Engineer's Statement

The letters by Mr. Lasley recalled a statement by Lieut.-Col. Harry A. Montgomery, Tulsa, Okla., district engineer for the Army engineers, during a speech at the Southwest Valley Association meeting in Little Rock on October 18, 1941. Colonel Montgomery charged in his speech then that failure to observe the 735 foot level for power had caused four damaging floods. He said that the Army engineers had recommended the 735-foot level, which left 960,000 acre-feet in the dam's reservoir for flood storage. When the dam's level was raised to 745 feet to get more power, only 540,000 acre-feet remained, he said. Further, he said, the dam had been relieved of the responsibility of getting additional lands



HALF CENTURY OF SERVICE—Edward Hartmuss, left, recently completed his 51st year with Westinghouse and is eligible for retirement, but he's still on the job. He is shown directing the assembly of a giant rotor, 30 feet in diameter and weighing 535 tons, a part of main unit L-6, a big hydro-electric generator now being installed in Grand Coulee's power house

for a five feet further flood storage, making it impossible to raise the lake level above 750 feet without flooding highways and railroads. This cut the flood storage to 245,000 acre-feet.

With the dam now operated by the Federal Works Agency, under the supervision of Douglas Wright, and the power pool maintained at 745 feet, only 245,000 acre-feet of flood storage is available, or just 25 percent of the amount proposed by the Army engineers for the dam.

•

Southwest I.E.S. Holds a Meeting

An instructive meeting of the Southwest Section of the Illuminating Engineering Society was held at Dallas, Texas, recently, at which a number of papers dealing with lighting's job in either "production" or "protection"—to paraphrase the description of I.E.S. president R. B. Brown at the meeting—were delivered.

The meeting was opened by P. M. Rutherford, Jr., regional vice-president of the I.E.S. who described the new "seeing tasks" created by wartime conditions which, in turn, have brought out new problems in lighting applications.

Harry G. Hrivnatz of Houston Lighting & Power Co. discussed the factor of skyglow in blackout and dimout practices and demonstrated street and flood lighting equipment to control skyglow. R. F. Biesele of Westinghouse pointed out that traffic accidents are taking a tremendous toll of lives, in his paper on "Safety Lighting for Access Roads." W. E. Folsom of the Dallas Power & Light Co., discussed lighting in the post-war era and round table discussion following the talk stressed the need for extension of information on lighting in the colleges. Industrial lighting in wartime was covered by E. L. Goddard of the Houston Lighting & Power Co., L. V. Maxson of the Crouse-Hinds Co., Lieut. Pope Lawrence of the Texas State Board of Health, R. B. Brown, Boston Edison and I.E.S. president, and H. R. Heitzman of Benjamin Electric Co. and Logan Knapp of Dallas Power & Light Co.

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Code Supplement Issued

The second edition of the supplement to the 1940 National Electrical Code, replacing the edition of September 1, 1942, has been issued by the National Board of Fire Underwriters. The new supplement contains all the interim amendments to the 1940 edition of the code which have been approved by action of the electrical committee or by the emergency committee up to April 1, the date of issue.

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Big Thompson's 2nd Unit Operating

The second 10,000 kw. generator of the Colorado Big Thompson project at Green Mountain is going into operation, according to a recent announcement from the Bureau of Reclamation of the Interior Department. Primary purpose of the project is to provide supplemental irrigation water supply in northeastern Colorado. All construction with the exception of the Green Mountain Dam and power plant was halted last fall by WPB order.

Power from the new plant will be distributed by the Public Service Co. of Colorado for the duration and will serve Denver war industries, it was said. Ultimately six other power plants will bring the potential annual output of the Colorado Big Thompson project to about 900,000,000 kw.-hr.

MEETINGS

Previously Listed

Edison Electric Institute — Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 2-3. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

Pacific Coast Electrical Association—War problem conferences, southern section, Roosevelt Hotel, Hollywood, Cal., June 2; northern section, Fairmont Hotel, San Francisco, June 9. Victor W. Hartley, managing director, 601 W. 5th St., Los Angeles, Cal.

Illuminating Engineering Society — Great Lakes regional conference, Rackham Memorial Bldg., Detroit, Mich., June 5; G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland, Ohio. East Central regional conference, Lord Baltimore Hotel, Baltimore, Md., June 9. A. S. Turner, Jr., regional vice-president, General Electric Co., 1405 Locust St., Philadelphia, Pa. Northeastern regional conference, Shelton Hotel, New York, N. Y., June 11; C. C. Keller, regional vice-president, Holophane Co., 342 Madison Ave., New York, N. Y.

National District Heating Association — Annual meeting, Hotel Schenley, Pittsburgh, Pa., June 9-10. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

American Society of Mechanical Engineers—Semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Canadian Electrical Association—Annual meeting Seigniory Club, Quebec, June 17-18. B. C. Fairchilds, secretary, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education —Annual meeting, Illinois Institute of Technology, Chicago, Ill., and Northwestern University, Evanston, Ill., June 18-20. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

American Institute of Electrical Engineers — National technical meeting, Hotel Cleveland, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

Public Utilities Advertising Association — Annual meeting, Edgewater Beach Hotel, Chicago, Ill., June 24-25. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

American Society for Testing Materials—Annual meeting, Pittsburgh, Pa., June 28-July 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Clinic Speeds War Production Ideas

Representatives of nearly 1,000 Los Angeles war production plants met recently at the Southern California War Production Clinic, sponsored by WPB to effect an exchange of advanced technical ideas to speed war manufacturing.

A panel discussion on factory electrical equipment was included in the seven groups. T. M. Blakeslee, Bureau of Power and Light, was chairman and A. D. Brown, Allis-Chalmers Mfg. Co., general speaker. Subjects covered included:

Factory and Office Lighting—Industrial lighting for maximum production, H. J. Chanon, (General Electric); efficient office lighting for war plants, T. H. Shephard, (Bureau of Power and Light).

Emergency Rating of Electrical Equipment—General basis of apparatus ratings, C. L. Sidway (Bureau of Power and Light); emergency up-rating of electric motors, R. K. Collins (Westinghouse); war-time loading of wire and cable, H. J. Wheeler (General Electric).

Electrical Maintenance — Care of motors, Glenn Farr (R.K.O. Studios); care of control, Nels Swanson (Goodyear); maintenance programs, Howard C. Park (Goodyear).

Power Factor Correction—G. N. Hawley (Southern California Edison Co.).

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Columbia Storage Dam Survey is Completed

Surveys of Army engineers in northern Idaho and Montana for dam sites to assure constant water levels at Grand Coulee and Bonneville, through addition of 3,000,000 acre-feet of water storage, have been completed and the results of their investigations have been presented to the advisory board of Bonneville.

Under consideration for storage dams, according to D. L. Marlett, executive assistant to Dr. Paul J. Raver, Bonneville administrator, are sites on Flathead Lake in Montana and on Pend Oreille river and lake in Idaho. Executive sessions of the board are meeting to consider the investigations and Barclay J. Sickler, director of the power division of the Office of War Utilities; J. A. Krug, director of OWU, and Don Marquis, northwest power division chief for WPB, are attending the sessions.

May Output Continues Rise

The output curve continued the rise, started with the first week in May, during the latest week to bring it to a curve just short of the four billion kw.-hr. mark. The amount of electrical energy distributed by the light and power industry for the week ended May 22 totaled 3,992,250,000 kw.-hr., according to the Edison Electric Institute, compared to 3,969,161,000 kw.-hr. the previous week and 3,903,723,000 kw.-hr. for the week ended May 8. Figures for the latest week represent an increase of 18.1 percent over the corresponding week in 1942—a slight recession from the 18.2 percent gain registered the previous week.

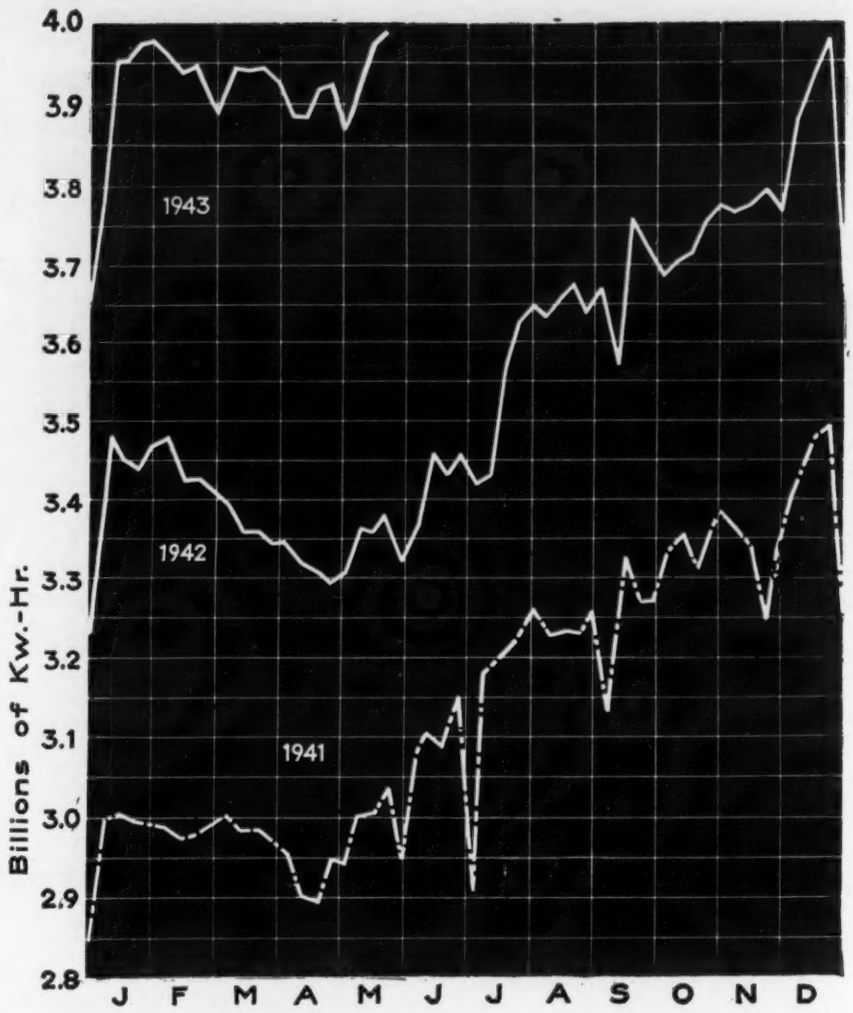
Only two sections of the country showed a gain during the past week—the Central Industrial region which increased its lead over the '42 figures from 16.3 percent to 16.7 percent, and the Southern states which went from a 17.1 percent gain to a 17.8 percent gain. The rest of the seven major geographic regions showed slight falling off from the figures for the week ended May 15. Biggest drop was in the West Central region due, no doubt, to flood conditions which have ravaged a large section of the middle west.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
May 22	3,992	May 23	3,380	May 24	3,040
May 15	3,969	May 16	3,357	May 17	3,011
May 8	3,904	May 9	3,365	May 10	3,001
May 1	3,867	May 2	3,304	May 3	2,945
Apr. 24	3,925	Apr. 25	3,273	Apr. 26	2,950
Apr. 17	3,917	Apr. 18	3,708	Apr. 19	2,897
Apr. 10	3,882	Apr. 11	3,321	Apr. 12	2,905
Apr. 3	3,890	Apr. 4	3,348	Apr. 5	2,959
Mar. 27	3,928	Mar. 28	3,345	Mar. 29	2,975
Mar. 20	3,947	Mar. 21	3,357	Mar. 22	2,983

Percent Change from Previous Year

	Week Ending		
	May 22	May 15	May 8
New England	+ 9.3	+ 9.9	+ 8.1
Mid-Atlantic	+16.3	+16.7	+13.3
Central Industrial	+16.7	+16.3	+14.0
West Central	+11.4	+14.2	+12.3
Southern States	+17.8	+17.1	+14.4
Rocky Mountain	+16.4	+17.7	+17.0
Pacific Coast	+31.9	+32.9	+32.9
Total United States	+18.1	+18.2	+16.0



Late Spring Cuts April Stream Flow

April stream flow was very appreciably above normal throughout the western Provinces of Canada and the northern intermountain and Pacific northwest states. This situation is a decided contrast to eastern Canada and northeastern United States, where subnormal temperatures retarded the melting of the heavy snow cover and resulted in subnormal April runoff and a delayed and possibly reduced total spring runoff, according to the April water resources review of the Interior Department's Geological Survey in collaboration with the Dominion Water and Power Bureau.

Submormal stream flow and more than normal recession in groundwater storage in a broad area from the northern tributaries of the Ohio River across the lower Mississippi River basin, Texas, New Mexico and Arizona reflects deficient precipitation in that area. Since last month stream flow has receded in relation to normal throughout Ohio River basin. Stream flow in Oklahoma, Arkansas and east Texas rose in relation to normal, but the flow in index streams in Arkansas and east Texas still remained below normal.

Storage for power, irrigation and municipal water supplies continues favorable, the review said.

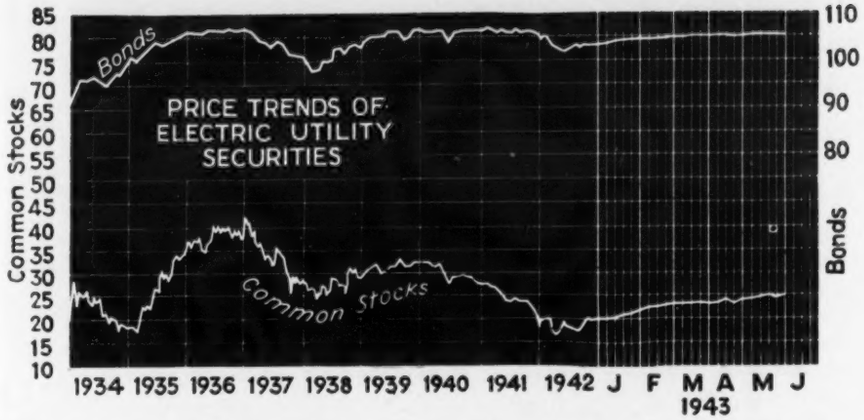
Floods associated with melting snow and ice jams were prevalent in western Minnesota, eastern Dakotas, along the lower Missouri river, in northern and western Wyoming, western Montana, Idaho, northern Nevada and Oregon. The floods along the Missouri River from Bismarck, N. D., to Omaha reached the highest stage during the period of survey records. In Idaho and Oregon, also, flood records were broken.

Revocation of "War Time" Tabled in Illinois

Legislation pending before the Illinois House of Representatives to revoke war time in that state was tabled by its sponsor after Paul B. Vallee, administrator of Order U-1, explained to the body the need for war time.

Vallee, assistant Office of War Utilities attorney William A. W. Krebs, Jr., and OWU Information Chief Russell Hogin appeared before the Legislature May 18 at the invitation of Speaker Elmer J. Schnackenberg. In three other states, Michigan, Ohio and Georgia, legislation was adopted revoking war time, and similar legislation is pending in Florida, OWU officials report. In the three states which dropped war time increases in peak loads were not so great as they might have been since most cities remained on war time.

Utility Stock Prices Rally; Bonds Firm



Prices of electric light and power stocks regained ground the past week. "Electrical World" index advanced to 25.1 from 24.8 the previous week; last year, 17.5. Bonds held firm at 105.5; last year, 105.6

National Deplores Dissolution Haste

Efforts of National Power & Light Co. to comply with the "death sentence" provisions of the Holding Company Act and, at the same time, preserve values "have proved difficult," Paul B. Sawyer, president, told stockholders in the annual report just released. National, Mr. Sawyer said, may be the first major holding company to go out of business under the act.

The report pointed out that nearly two years was required for National to dispose of its holdings in the Houston Lighting & Power Co. and that National had to sell about half its Houston holdings by competitive bidding and received only one bid for the block of stock, yielding the sum of $12,582,128 in cash to National. With the proceeds of this sale and additional treasury funds, Mr. Sawyer said, it is proposed to liquidate 138,000 shares of its outstanding $6 perferred stock at $100 per share, plus accumulated dividends. Provided the SEC approves the sale of 16,806 shares of $7 preferred stock of Carolina Power & Light Co., owned by National, the report said, there will be sufficient funds to retire all the remaining preferred stock of National on the basis mentioned. This would open the way for distribution to National's common-stock holders of the common stocks of Birmingham Electric Co., Carolina Power & Light and Pennsylvania Power & Light Co., together with certain other assets.

National's experience with the Houston sale, it is pointed out, "is an example of the disruption of values brought about when the abnormal conditions of war are imposed upon the already difficult process of liquidating large utility assets within a restricted time limit."

•

Ogden Divestment Plan Approved

The Securities and Exchange Commission has given its conditional approval to a voluntary plan of reorganization of the Ogden Corp. and its subsidiaries to comply with Section 11 of the Holding Company Act. Approval was also given to an amended plan of reorganization of Utilities Power & Light Co., predecessor company, designed to eliminate Ogden as a holding company (ELECTRICAL WORLD, March 13, page 20; April 3, page 72).

The plan provides for the divestment of interest by Ogden in all its subsidiaries which are registered holding companies or public utility companies. In the case of certain companies, however, it is provided that the securities of the companies shall not be sold prior to the recapitalization of such companies to bring them into compliance with Section 11 (b) (2)—the corporate simplification phase—of the act. These companies include the Laclede Gas Light Co., Interstate Power Co., Missouri Natural Gas Co., Central States Utilities Corp., Central States Power & Light Corp. and Missouri Electric Power Co.

Recapitalization is provided for under the plan in the cases of the Laclede Gas Light Co. and Interstate Power while liquidation and dissolution of Central States Utilities Corp. and its subsidiaries, Central States Power & Light and Missouri Electric Power, after disposal of their assets for cash.

Proceeds from the sale of Ogden's investments in holding and public utility companies is provided for on a pro-rata basis to Ogden's common-stock holders, in addition to the new securities Ogden will receive on the recapitalization of the other companies.

FINANCIAL BRIEFS

THE SEC WILL RECONVENE its 1940 corporate simplification proceedings of the Electric Bond & Share Co. on June 9, it was announced recently, to consider the elimination of Bond & Share as the holding company for American Gas & Electric Co. and American & Foreign Power Co. and their subsidiaries.

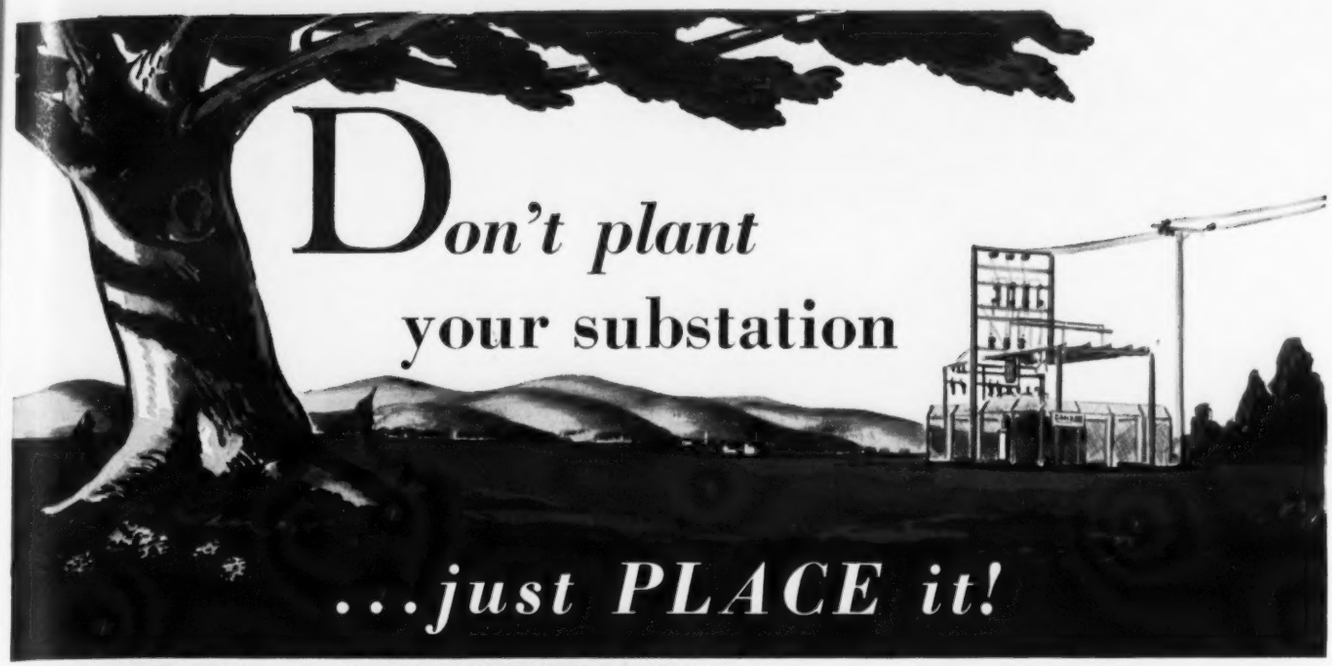
THE DELMARVA CO-OPERATIVE, INC., a group of Delaware bankers, has asked the SEC for permission to make an offer for purchase of Eastern Shore Public Service Co., subsidiary of General Gas & Electric Co. The latter company has already tentatively agreed to sell Eastern Shore to U.G.I. which proposed the purchase of the company as part of its integration proceedings. The SEC had stipulated that the deal be completed by July 31 and the Delmarva group asked the commission to extend the deadline 90 days to give them time to place a bid.

THE SEC HAS FIXED JUNE 9 for hearing on an application of Continental Gas & Electric Corp. for approval of the proposed acquisition from Illinois Iowa Power Co. of all the outstanding shares of common stock of Des Moines Electric Light Co. and Iowa Power & Light Co.

Utility Reports

	Net Income 1943	1942
*American Gas & Electric and subs.	$10,972,295	$13,521,143
*California Electric Power and sub.	915,819	785,916
*Carolina Power & Light.	2,371,463	2,837,463
*Central Arizona Lt. & Pwr.	858,231	642,938
*Cleveland Elec. Illum. and sub.	6,085,675	6,917,193
*Cincinnati Gas & Elec.	3,889,906	2,556,635
*Columbia Gas & Electric and subs.	11,461,116	7,544,469
*Dayton Power & Light.	2,299,569	2,217,338
*El Paso Electric (Texas)	550,012	628,745
*Houston Ltg. & Power.	3,038,649	2,714,367
*Key West Electric	61,343	79,005
*Metropolitan Edison	4,029,434	3,179,741
*Minnesota Power & Light	1,789,787	1,584,599
*Pacific Gas & Electric.	22,472,274	21,425,395
*Pacific Power & Light.	1,009,965	682,200
*Pennsylvania Power & Light	5,684,018	5,720,749
*Savannah Elec. & Power.	204,471	190,615
*Virginia Elec. & Power.	3,996,059	3,766,300

*Twelve months ended March 31.



UNIT SUBSTATIONS

are quickly installed and easily moved

WAR-PRESSED utilities and industrials are greatly accelerating the already-strong trend from *piecemeal* to *unit* substations—from *planting* a substation piece by piece to *placing* it as a unit. Unit design means quick installation, and it means you can easily move your substation to follow load shifts.

Actually, the advantages of unit substations begin with their selection. You can select a complete, standard substation as one unit, order it with a simple functional specification, and have it shipped—*factory assembled*—weeks sooner than would be possible for a piecemeal assembly.

Then, by installing these compact, safety-enclosed units right at load centers, you can greatly shorten secondary runs, save precious copper by the ton.

Finally, you have a *co-ordinated* substation—every part designed to fit and function with every other part. Engineers see the benefits in remarkable service records. And everyone appreciates the vastly improved appearance, which gives greater flexibility of installation in urban areas.

Factory-assembled sections are slid into place quickly. The substation can be moved elsewhere just as easily, should it become desirable.

Our attractive, new 36-page bulletin will give you useful information. Ask your G-E office for GEA-3800 or write direct to General Electric, Schenectady, N. Y.

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GAS-FILLED CABLE take

NOW

MEDIUM-PRESSURE "GF

HERE is an extension in the operating range of gas-filled cable that gives you all the advantages of low-pressure "GF"—the cable which has given years of satisfactory service on circuits from 10 to 40 kv. This new *medium-pressure* cable is designed for high-voltage circuits from 40 to 69 kv.

To you, the most important feature about this cable is that it is just as easy to install and maintain as is the low-pressure "GF."

How the operating range was extended

This higher operating range has been made possible by increasing the inside pressure to 45 psi, as compared with the 15 psi for the low-pressure cable. Moreover, the same high factor of safety that is built into low-pressure "GF" has been retained in this new cable.

For more detailed information on "GF" cable—

1. Write for Bulletin GEA-3652. You will want to keep this publication for your files; it contains information on what "GF" cable is, how it is used, its performance and advantages, and the accessories needed.

2. The advice and experience of G-E cable engineers are always available to you. Call on your G-E office at any time. One of our cable specialists will be glad to discuss with you this new voltage range of "GF" cable and its possibilities. *General Electric, Schenectady, N. Y.*

4 advantages of "GF" cable

1. Easy to install—no auxiliary manhole equipment

2. Only routine inspection and maintenance—no specially trained personnel need

3. No profile problem—no compound migration

4. Self-supervision—prompt, automatic warning if a leak occurs

another step forward

FOR 40- to 69-KV SERVICE

GENERAL ELECTRIC

501-18-1200

You Wanted Them Smaller

HOW'S THIS?

Two-bushing
Outdoor Potential Transformers
Type E-236 (Supersedes Type E-116)
Pyranol or Oil-filled
24 to 69 kv

Height reduced . . . . . 15 to 50 per cent

Weight reduced . . . . . 10 to 60 per cent

Liquid volume reduced . . . . . 45 to 90 per cent

You Can Put Them up in the Structure...with Your Current Transformers

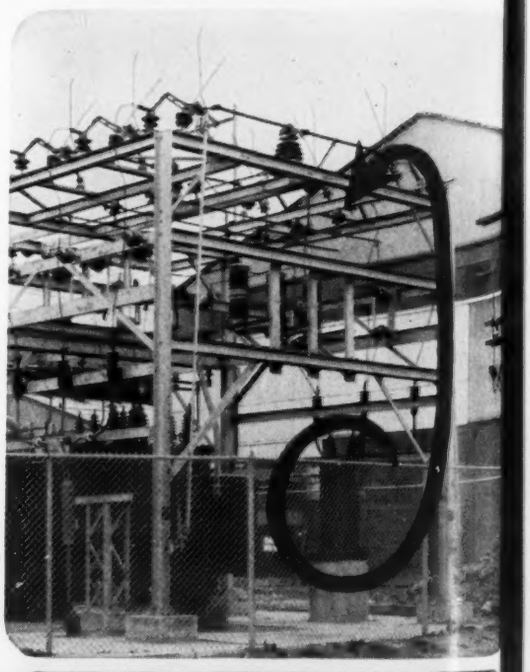
SIMPLIFY CONNECTIONS—Their light weight and small size enable you to mount them in the structure—thus simplifying primary (high-voltage) connections.

SAVE SPACE—Mounting in the structure saves valuable ground space.

SAVE FOUNDATION EXPENSE—When you put them up in the structure you don't need to construct a separate foundation.

HANDLE THEM EASIER—Their reduced size and weight make them easier to install.

REDUCE MAINTENANCE—Forget about testing or inspecting the insulating liquid; it's hermetically sealed in—there are no gaskets.



Here's How They're Built

ACCURACY—These transformers meet the highest accuracy classification—¼W, ¼X, ¼Y, ¼Z—and they're suitable for both metering and relaying.

INSULATION—Ample insulation is provided to meet the ASA standards on both impulse and low-frequency tests.

BUSHINGS—Sealed bushings eliminate gasketed joints.

TANK AND COVER—Steel plate is used, and the tank is hermetically sealed by welding the cover to it—again, no gaskets.

CORE—The core is rectangular in shape, and is similar to the *Spirakore design used in G-E distribution transformers.

***PYRANOL OR OIL-FILLED**—For the best protection to your system, you'll want to specify Pyranol—General Electric's non-inflammable cooling and insulating liquid. It has high dielectric strength and is chemically stable.

*Reg. U. S. Pat. Off.

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

604-11-6400

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Transformer Acids and Sludges Trapped

By T. W. BUTTNER, J. G. MARTIN
Columbus & Southern Ohio Electric Company

Since 1940 some seventy-nine rectifiers have been installed in transformers, 95 percent of them conservator type 500-15,000 kva., to de-

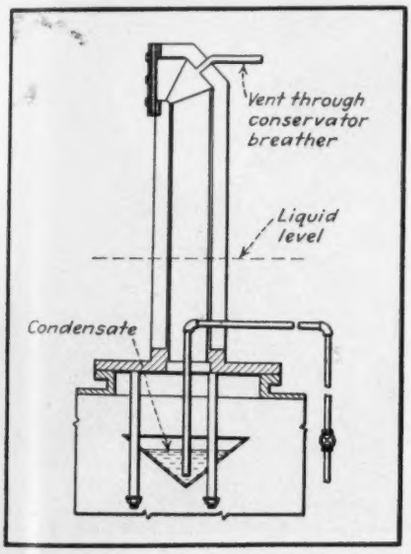


FIG. 1—Air-cooled pressure relief stack collects acids and sludges for removal from trap

hydrate and deacidify the oil. Since installing them the operating temperatures of some units have been lowered as much as 15 C.; dielectric strength has been raised to 30 kv. or higher. Filtering is expected to be unnecessary. In some cases it has been necessary to remove the trap after two years and scrape out the accumulation of insoluble sludge.

The rectifier is designed around the pressure-relief stack as supplied with most power transformers. Below the stack is placed a conical condensate receiver (Fig. 1), which can be emptied by opening the drain-pipe valve outside the transformer case. Transformers which show excessively high acidity of oil are provided with coils on the rectifier for liquid coolant to increase condensation and so accelerate rectification.

Trapping and collection of water, acids and other impurities as they are formed is effected. Early oxidation and removal of the easily oxidized, acid-forming constituents is followed by effective clean-up of the more slowly produced acid compounds associated with their slower reaction rates.

In accounting for the efficacious functioning of the rectifier it is assumed that minute corona discharges create ozone, which is a powerful oxidizer which acts on susceptible components of the oil and further unites with nitrogen from the air to form nitric acid in the presence of such moisture as is also present in the oil. Fatty acids, which are

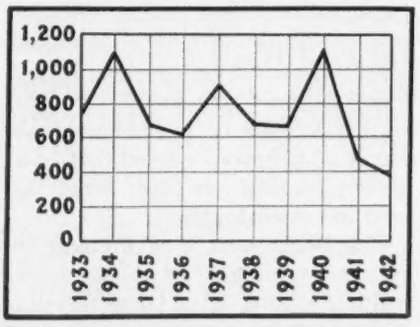


FIG. 2—Cost of maintaining transformer oil has dropped progressively since rectifiers were first installed in 1940

Number of 500 kva. and larger transformers on the system ranged from 44 in 1933 to 62 in 1942; total megavolt-amperes from 190 to 255. This curve shows the total hours of truck and filter-equipment time.

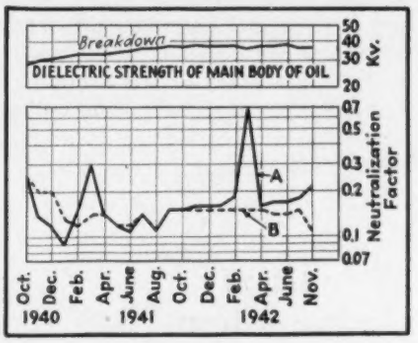


FIG. 3—Tests on 1,800 gal. of oil in a 7,500-kva., three-winding transformer show steady improvement in characteristics

(a) Sample from rectifier.
(b) Sample from main body of oil.
High peak on acidity curve due to pumping oil through centrifuge in preceding month to aerate and accelerate rectification.

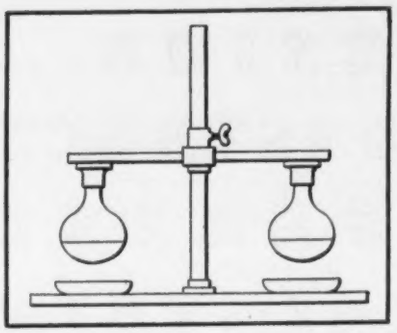
soluble in water, are also formed, and these acids increase the conductance of the oil. Rise in temperature of the oil converts these fatty acids to well-oxidized oil-insoluble sludges. Meanwhile some of the inherent hydrocarbons are being polymerized to the oil-insoluble state.

These bodies—water solutions of acids and colloidal sludges—have specific gravities higher than that of the transformer oil and thus settle to the trap of the rectifier.

•

Infra-Red Used in Boiler Water Analysis

Application of heat directly to the object material instead of by conduction through the bottom of the holding vessel is a feature of infra-red particularly useful in the laboratory of a power plant. The accompanying illustration shows how infra-red is employed for evaporation of water



SOLIDS in boiler water dried out by infra-red heat

in the quantitative determination of solids in boiler feedwater in a Southeastern power station. Two lamps are used so that simultaneous determinations can be made for checking against each other or for averaging. The lamps are mounted on a cross-bar which is movable vertically so that the applied heat can be regulated.

•

Wire Rope Conservation

The various kinds of grab-bucket and scrapers of carrier and power drag types used at power stations for handling coal in and out of storage present a more acute problem of wire rope maintenance today than in previous times when new cable could be readily obtained and pulled in. For this reason the following specific suggestions, presented by the makers of preformed rope, but just as applicable to other cable, are of real value.

The closing line of a grab bucket in which damage usually occurs at the small sheaves in the closing mechanism: Use rope of extra length and cut off damaged section at bucket end. When the rope is too short to crop, it can be turned end for end or a short length of new rope can be spliced on at the bucket end.

Damage to the tag line of a grab bucket is usually found in the section from the bucket to and around the small idler sheave on the boom: Use rope of extra length with surplus doubled back at counterweight end. Damaged length is cut off, leaving the rope still long enough for use.

The hoist cable of an overhead traveling crane wears first at the equalizing sheave: Crop off 2 to 2½ in. at one end of drum about every three months. All cuts must be made at the same end of the drum. Each cropping shifts the position of the rope at the equalizing sheave.

All ropes of a carrier scraper wear at the sheaves and drums: Use extra length rope with surplus carried on spare reel on scraper. Crop off 6 ft. at power unit end as frequently as appears necessary.

Inhaul and outhaul cables of a power drag scraper wear at the tail sheaves and at the scraper end: Cut off 15 to 20 ft. at the scraper end.

•

Synchronizing Wound-Rotor Motors—I*

By A. F. METZGER
Engineering Department,
General Electric Company, Boston, Mass.

Frequently industry finds it necessary to drive two parts of a machine at variable speed and yet keep the speed of each unit in exact synchronism. There are several widely used methods of doing this. Two such methods will be discussed: (1) that of synchronizing the operation of wound-rotor motors of polyphase type having identical ratings, and (2) that of synchronizing wound-rotor polyphase motors of different ratings. Such synchronous operation of several wound-rotor motors is commonly called selsyn operation. Selsyn operation of motors having different ratings is not extensively known to be possible.

Least expensive method of synchronous operation of several motors, provided its limitations do not make some other method imperative, is to use wound-rotor motors, with their secondaries paralleled and connected to the same resistor. With such an arrangement the motors will stay in synchronism even under differing load conditions as long as the speed does not exceed 80 percent of synchronous speed. Some synchronizing torque will still be present above 80 percent synchronous speed, but it decreases rapidly as the speed approaches synchronism.

This characteristic of wound-rotor motors was used to advantage in the traction motors of a large traveling coal hoist. Here it was necessary to drive the wheels on both sides of the truck at exactly the same speed to prevent twisting the tower off the rails.

In this case the use of wound-rotor motors eliminated the use of a cumbersome line shaft and gearing and also permitted building the traction motors into the truck, since the load could be divided between eight small motors instead of being concentrated in one large motor.

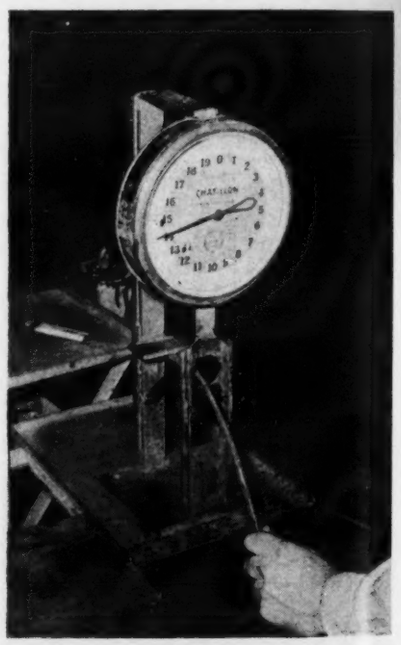
This represents a typical application of wound-rotor motors for selsyn operation where all of the motors are identical.

The application of such a drive to coal hoists and cranes necessarily involves careful engineering in settling the motor sizes and other details, but the principle has been proved in a number of successful applications.

*First of three installments.

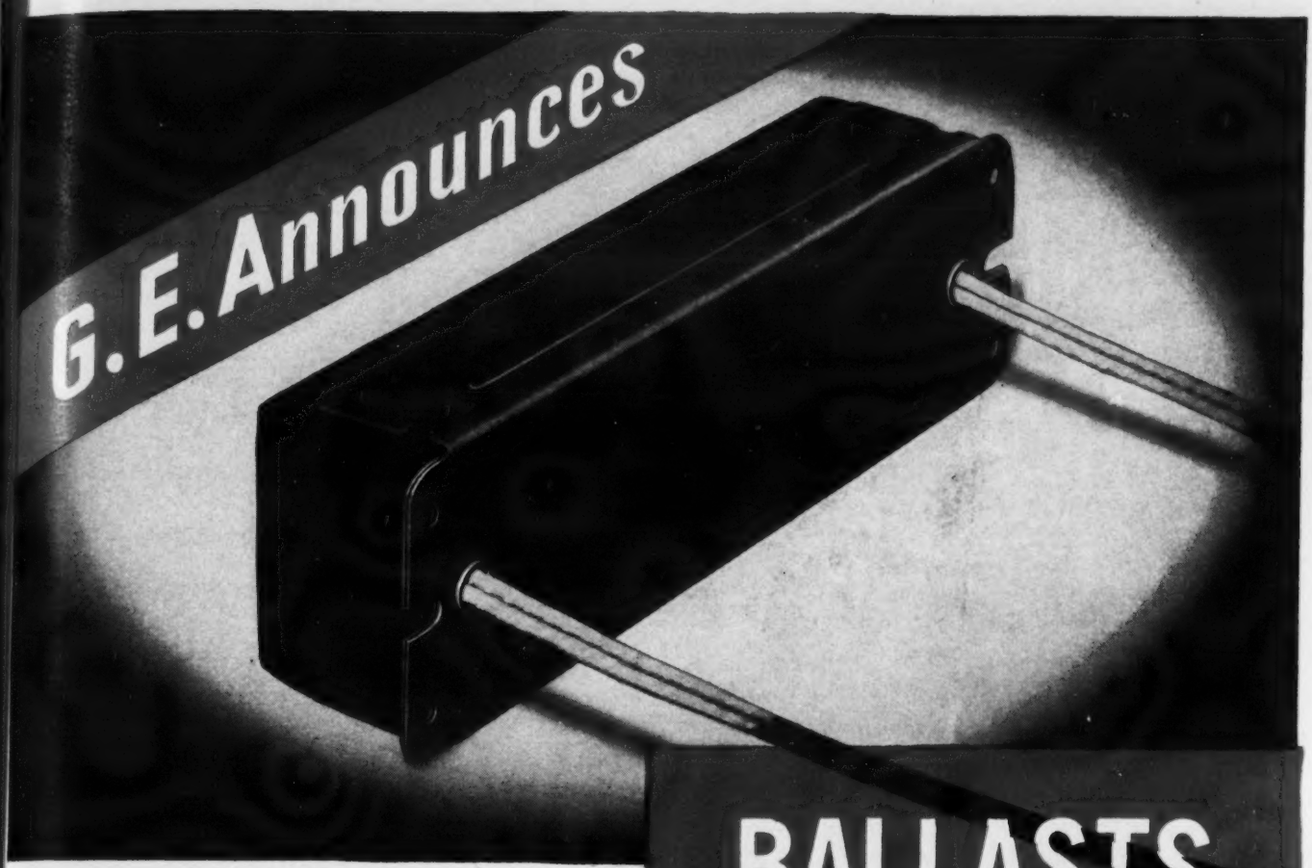
•

Tells Hard From Soft Drawn Wire



When there is any question, it is easy for the most inexperienced men to detect hard from soft-drawn wire using the home-made device above, built in the salvage shops of a middle western utility. All that is necessary is to push the wire in question through a fitting attached to an inexpensive spring scale, catch it under a fixed stop and bend the wire with a sharp downward thrust, noting the scale reading obtained.

With No. 6 hard-drawn wire this particular instrument will register about 14 lb. and soft drawn wire about half that, or 7 lb. The exact



BALLASTS WITH LEADS OUT the BOTTOM

They save pounds of critical material per fluorescent fixture

AS AN aid to fixture manufacturers in their programs to save critical materials, we now offer this addition to our line of war-plant ballasts. These ballasts differ from those of conventional design *only* in location of leads, which come out through two bushed holes in the base plate (one at each end).

Installation simplified. These new ballasts can be mounted completely exposed atop a narrow, shallow wiring channel just wide enough and deep enough to enclose the leads. The saving in iron and steel is therefore substantial, since there is no longer need to allow room for the complete ballast in the fixture itself.

Because of their exposed location, these ballasts will operate in lower ambient temperatures—which contributes to long ballast life. They do not require special installation features, such as ventilating louvers and conduction plates.

Wide range of ratings. Ballasts with leads out the bottom are available in 40-watt Tulamp and three-lamp ratings, 100-watt Tulamp and Forlamp ratings—those used most in war plants.

For more details about this improved design, and for information on the rest of the G-E line of ballasts for fluorescent lighting, send for your copy of Bulletin GEA-3293. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

reading has no significance, as the test is merely comparative; however, the difference in the two readings is large enough to indicate clearly which wire is soft-drawn and which is hard-drawn. The device has been very useful in training unskilled help.

•

Card Records Yield Continuous Inventory

A continuous inventory of poles, pole-mounted equipment, transformers and electric service equipment on customers' premises is maintained by the Menasha Electric and Water Utilities, Menasha, Wis., on the cross-referred system of filing cards shown. Designed primarily for evaluation and tax purposes, the card file has been found a most convenient reference in system maintenance and trouble-shooting operations.

The pole and equipment record carries columns for recording all hardware and other pole-mounted apparatus on the system. In cases where the pole carries a transformer this record card bears a cross-reference to a separate transformer record card that carries a complete history of the transformer, its past and present mounting location, class of load served as well as dates of repair and inspection.

In the case of the Menasha municipal utility, the city owns all electric service equipment on the customers' premises up to and including the service switch. A separate card record therefore is maintained for each installation listing all city-owned equipment on the premises. By means of the "utility number" on this card reference can be made to a separate meter card (not shown), on which a complete meter history as well as dates of test are indicated. Because of the relative frequency of changes meter data are not recorded on the same card with the more permanent service equipment at a given premises.

1M 8-1-41B

WATER & LIGHT COMMISSION, MENASHA, WISCONSIN

ELECTRIC SERVICE RECORD

Utility's No.	1977			Ground Clamp	I
Conduit	22 Ft.	Conduit	4 ft.	Pipe Clamps Used	5
Size Conduit	1¼	Size Conduit	½	Entrance Cable Used	
Lbs. Used	2	Lbs. Used		Entrance Cable Head	1
Elbows Used	2			Labor Cost $	
Wire Used	100 Ft.	Wire Used	37 ft.	Bushings	1-1¼, 1-½
Size Wire	# 8	Size Wire	# 12	Locknuts	4-1¼, 4-½
Size Switch	60 A			Meter Jumper	
Mfgr. Switch	Sq. D			Wire Used	6 ft. # 8
Type No. Switch	NF-63			Date Installed	Dec. 1939
Location Address	421 Broad				

25 kva -HE	Moloney		83028	205
Kva	Type	Make	Mfg's No.	Utility's No.
2200	2	220/110	4	1¼-2⅛-3⅛-5-6½
Primary Volts	Wires	Secondary Volts	Wires	Primary Taps
1	3-7-23			
Phase	Date Bo't	Inv. Ref. No.	$ Price	$ Fr't & Cge.	$ Total Cost
Date Discarded	Invty. Val. 19	$ 19	$ 19	$ 19

Class of Load	Date Installed	Date Removed	Location	Date Repaired	Remarks
Power			Manitowoc & Fourth	8 17 42	Ins.& Painted
			Pole 1356-1357		

TRANSFORMER RECORD—Electric Dept.—City of Menasha

(over)

1M—8-1-41-A

MENASHA ELECTRIC & WATER UTILITIES

POLE AND EQUIPMENT RECORD

POLE NO. 1356

Transformer Setting

TAXING DISTRICT

MAP AREA

		POLE				GUYS			ANCHOR	GUY GUARD	CLAMPS	STRAIN INS.	GUY HOOKS	POLE STEPS	CROSS ARMS			BRACES		CAR BOLT	LAG SCREWS	
		KIND	LGTH.	CLASS	TREAT	1/4	5/16	3/8							5' 7"	8'	PIN	28"	26"	3/8-4	1/2-4	3/8-3
			35		BT		70		2		6	3		5	3	2	1	4	1	5	6	4

Bolts		RELAYS		PINS				INSULATORS			RACKS		WASHERS	KNOBS LM	LIGHTING ARRESTORS		PRIMARY CUT-OUTS	STREET-LAMPS					
D	S	DOUB.	SING.	WOOD	STEEL	BOLT	LAG	GLASS	PORC.	SPOOL	LARGE	SMALL			L V	NEUT'L		LAMPS	CHAIN	HOOKS	RINGS	LOCKS	PUL'S	MAST.
2	25		1	4	6	9			15	12	1	2	9											

Street Lt. Sw 1

Transformers # 205--212
1—50 kva., #2 Ø 1
2—25 kva.,

CARD RECORDS maintain continuous inventory of transformers, poles, pole-mounted equipment and electric service apparatus on municipal utility system

LARGE BANKS OF CAPACITORS PROVIDE A QUICK, LOW-COST WAY OF RELEASING SYSTEM CAPACITY

QUICK: The *availability* of Pyranol capacitors as a source of reactive kva makes their use the quickest method of releasing system capacity for heavy war loads —especially now when materials, and labor to manufacture equipment, are at a premium.

LOW COST: Pyranol capacitors can be put on a system at a cost of well under $10 per kva. The relatively high-cost system facilities can then deliver more kilowatts. This is of vital importance in the wartime drive to obtain maximum kilowatts from present facilities. Savings in critical materials, and ease of installation and switching to meet variable load demands, are also important considerations.

INSTALL THEM IN LARGE BANKS NEAR THE LOAD: Banks of G-E Pyranol capacitors are available as large outdoor and indoor rack-type equipments. Many utilities have found it advantageous to build their own outdoor racks of wood and standard-line hardware, so that they can use these capacitors in smaller groups on distribution circuits when the emergency need for larger banks is past.

Ask your G-E representative for his suggestions on the application of capacitors in large banks. He'll be glad to help you with such problems as fusing, relay protection, and switching. Or write for Catalog GEA-2764B. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

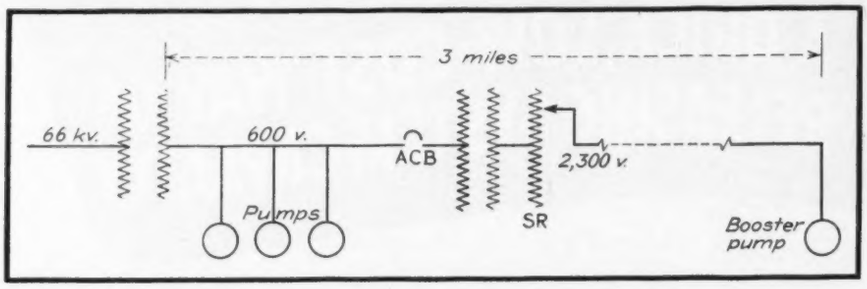
407-46-5700

Line Reactance for Motor Starting

By E. R. BONDS
Robert & Company, Inc., Atlanta, Ga.

Use of line and transformer reactance for motor starting was the solution found by engineers of Robert & Company for the problem of increased delivery of water to an industrial plant from a pumping station several miles away. A 250-hp. booster pump in the pipe line was determined to be as effective as, and more economical than, increasing the pipe size and adding capacity to the pumping station.

The electric service nearest to the place selected for the booster pump was 66 kv. at the pumping station, 3 miles distant. The transmission potential was stepped down to 600 volts for the pump motors at this point. Transformer capacity was sufficient to carry the booster pump, but 600 volts is a pretty low potential to run 3 miles to serve a 250-hp. motor. To extend the 66-kv. line to the booster would be a rather expensive construction job. And then, since the booster was to be unattended, there would be the expense of control circuit and equipment.



SCHEME of remote motor energy supply and control

The accompanying diagram shows how energy supply and control for the booster were combined in one circuit to result in minimum cost for the job. A 2,300-volt line, calculated to the proper reactance value, was run to the booster from the pumping station and the booster motor connected directly to it. Service was taken from the 600-volt bus at the pumping station through a 600/2,300 volt transformer. Control resides in a manual air circuit breaker equipped with thermal overload protection and in an automatic 10 percent single-step regulator such as is used on rural service lines.

In operation the circuit breaker is closed and the current drain of starting pulls the voltage down to around 1,500 at the motor. The regulator, standing at zero position, sets about to raise the voltage. The time delay of the regulator just about coincides with the decay of starting current, with the result that the 10 percent boost of the regulator is sufficient to bring the motor-running voltage to its nominal 2,300-volt level.

•

Sleet Effects Given Engineering Study

Following a disastrous sleet storm, the engineering department of the Western Massachusetts Electric Company, Springfield, addressed 16 written queries to the distribution department, western division, on the effects of the disturbance on local lines, with the object of ascertaining points in design and construction which might be improved in subsequent work. From these inquiries the following points are presented:

The approximate total numbers of poles broken from weight of conductors and ice were 23 pine, 66 Western red cedar and two chestnut. Tree branches broke in addition one pine, one chestnut and nine red cedars. Most poles broke at ground line. All chestnuts did, and about 21 pine and 67 cedars. Red cedars broke in two and sometimes three places. Breaks at telephone gain and at butt were most pronounced in the red cedars. Most of the breakage was where the spans were approximately 300 ft. Two longer spans broke guys and pulled poles ahead so that wire rested on the ground, but the poles did not fail. There was no appreciable difference in ground line movement of different pole types. Deeper setting does not appear desirable. There were approximatly 18,000 wooden poles on the division. (Many of these lines are 4,600-volt circuits, No. 2 ACSR conductor.) Prevailing poles are 30 and 35 ft. long.

Guys were $\frac{5}{16}$-in. Siemens-Martin and 51 failed. Strand breakage accounted for 47, clamp failure one, attachment to tree, three. There were no strain insulator failures in guy construction or pole attachment failures. About 200 wooden crossarm failures occurred and there were ten failures of braces, two of bolts and 50 pins. Dead-ends on vertical corners remained intact. Where wires failed, conductors stretched and broke. (In some cases sleet formation built up to 4 in. in over-all diameter.) In proportion to the amount of wire trouble in short and long spans there was about an equal amount of breakage of conductors in both types of construction. Insulator breakage was a big item on broken poles and arms, but was practically nil where crossarms stayed in air. As most crossarm breaks occurred on long spans, this is where insulator trouble was most prevalent. All conductors which did not break and go ahead on the line came back to at least 70 percent of their original height. More lines were out of service due to icing of conductors, although tree troubles were serious.

Tree Locations

It was suggested that to minimize tree trouble a more comprehensive trimming program would be desirable, stressing tree locations more when erecting lines. Experience indicated the desirability of using heavier guys on long span construction and erecting poles adjacent to hard corners with dead-end construction and head guys, even though this would increase cost over present practice. It was not felt that money could wisely have been saved by reducing strength in any part of the distribution system which had no failures during this ice storm. The storm showed the desirability of designing lines with shorter spans where there are corners and dead-ends. Joint guys should be the exception rather than the rule. Class 4 poles should be the minimum for hard corners and dead-ends as well as for transformers. Stronger guying of all lines was recommended, especially on long spans. Double guys on hard corners and dead-ends are favored, to prevent breaking of poles in the middle.

The method of restoring service was straightforward; temporary re-

pairs were made until all yearly customers were served, after which permanent repairs were made for these customers. This program proved satisfactory and involved little extra cost above the normal procedure of making permanent repairs to restore service.

•

Lineman, Patrolman Training—III*

By C. T. MALOY
Superintendent
Transmission and Communication Department,
Southern California Edison Co., Ltd., Los Angeles

For advancement to the fourth step in the apprentice training schedule and at the same time be granted a rating of second-class lineman, an employee of the Southern California Edison Company must assimilate more important features of transmission line work. Some of the features are:

1. Be an expert in climbing poles and towers.
2. Be completely familiar with materials and standard construction methods for telephone and transmission lines.
3. Have a practical knowledge of strength requirements and "stress and strain" as applied to line work.
4. Be capable of operating power units that are used to tension lines or raise poles.
5. Know the proper and safe methods for raising poles and using rigging near energized lines.
6. Know the routine that is necessary to de-energize circuits and properly ground them for work.
7. Be familiar with all orders that govern conductors or working conditions.
8. Be capable of applying first aid.
9. Be able to do all line work of a routine nature without the direct supervision of a first-class lineman or patrolman.
10. Know line conditions to the extent that he can make a patrol of a line and report any conditions that are a hazard to the line.

The next step is the rating of patrolman or first-class lineman. In order to be granted either rating further important features of transmission line work must be assimilated, such as the following:

1. Know the characteristics of transmission and communication circuits, and know how and why they are transposed.
2. Have a practical knowledge of how to work on and near energized circuits, and know the proper use and care of live line tools.
3. Be capable of training groundmen and apprentices in safe ways of doing line work.
†4. Be capable of making splices in 220-kv. conductors.
5. Know the rules and regulations as set forth by the Railroad Commission for overhead line construction.
6. Be capable of making up such maps and reports as are necessary properly to account for time and material.
7. Know the many common causes of trouble on transmission and communication lines, and be capable of making an intelligent report of line conditions.
†8. Be familiar with the lines of the patrol on which he is working and know any hazards or conditions peculiar to that division.

After an apprentice has been advanced to the position of patrolman or first-class lineman, he can be advanced to other positions of greater responsibility, as they are vacant, in accordance with his ability, industry and initiative as compared with other men of the same classification.

*This concludes a series of three articles which began in the May 1, 1943, issue of "Electrical World."

†Not required for first-class linemen.

•

Quick Repair of Fans by Arc Welding*

A maintenance job on two induced-draft fans was necessitated due to blade wear by fly ash drawn from furnaces. Both fans coupled direct to 30-hp., 975-r.p.m. constant-speed motors are used in conjunction with two forced-draft fans and two water-tube 165-psi. boilers in the plant of the Dakota Public Service Company, Bismarck, N. D.

Repair of the blades was made by Leslie L. Bradley, chief mechanic, who used only arc welding so as to eliminate the danger of warpage and resultant stresses in the fan rotors. This method of repair was employed due to the fact that new blades were not obtainable when needed.

Small plates were welded to the blades for the first repair job because small parts of the blades were worn. Larger plates were welded on when the blade had worn enough to require the second repair job. This repair arrangement according to the original planning allowed two repair jobs on each fan rotor before the remaining original sections of blades are worn too thin and new blades are required. Hardness of the plates was the same as the original blades. Efficiency of the fans has not been reduced, as far as can be determined.

Each induced-draft fan has twelve blades. First repair was made after 17 months of service. An iron plate 4x5x$\frac{1}{8}$ in. was welded to each blade. Where the plate was not large enough to cover all the worn part the blade was reinforced at the worn places by welding with ordinary coated steel rod over these places on the back of the blade and then by refacing the blade front where it had worn thin.

Both of the fans were repaired alike and within a month of each other, and then put in service with both boilers converted to operate at 450 psi., each having a steaming capacity of 35,000 lb. per hour.

After twelve months operation under the changed conditions one fan was reconditioned by cutting out all of the first repair plate and most of the original plate where it showed any wear. Amount cut out was 5$\frac{1}{2}$x8$\frac{1}{2}$ in. on each blade. New plates 6x9x$\frac{1}{8}$ in. were welded on back of each blade, overlapping the original blade $\frac{1}{2}$ in. on two edges and the third edge butted against the rotor rim. After being in service 16 months the second induced-draft fan was repaired in the same manner as described above.

Total savings in cost by arc welding amounts to $225.40 (see table of comparative costs), based on an estimated cost of installing new blades each time the blades become worn, and cost of balancing the rotors being the same in both cases.

Comparison of Costs

Welding Cost

Welder, 10 hr. at $0.90/hour	$9.00
Helper, 3 hr. at $0.50/hour	1.50
Material for plates	3.00
Power for welding, 50 kw.-hr	1.00
Welding rod, 8 lb	2.40
Cutting out old plates	.75
Total	$17.65

New Blade Installation Cost

New blades, 12 at $4 each	$48.00
Labor of installing (minimum)	25.00
Rivets	1.00
Total	$74.00
Savings by arc welding	$56.35
Total for 4 repair jobs	225.40

In addition to cost savings, availability of equipment must be considered. The fans were out of service ten to twelve hours each time they were repaired. Outage time for a new blade installation would be 40-50 hours.

Although the cost of labor and availability of fans is approximated for a new blade installation, in all probability these values will be too low because the fan housing has to be dismantled for blade replacements.

*Adapted from paper submitted in contest for award by the James F. Lincoln Arc Welding Foundation.

SIGHT
FOR VICTORY
PRIVATE

G-E MAZDA LAMPS

LIGHTING MEN have long realized their responsibility to America at war. They have helped to add countless man hours to factory production through improved seeing conditions.

Fully aware of the effect of lighting on production, safety, spoilage, health and morale . . .

Fully aware of the fact that lighting equipment uses critical material . . .

And fully aware of the ways and means of getting the most out of present lighting equipment . . . these men are working with their war-plant customers to help them in every way possible.

Among the things they are recommending and helping their customers to do are:

—Cleaning bulbs and reflectors on a regular schedule.

—Cleaning walls and ceilings—paint if necessary—to reflect all possible light on to the working plane.

—The proper placement of fixtures so that shadows on the work are eliminated.
—Shading of bare bulbs to cut glare to a minimum.

—All of those things that improve seeing conditions with a minimum use of critical materials.

Some people call it conservation. Others call it making the most of what we have. Another name for it is just plain Yankee ingenuity. Whatever you call it, it's the way the Lighting Man is discharging his responsibility to America at war.

"SIGHT FOR VICTORY" This month the whole lighting industry is cooperating in an effort to help all war plants—large and small—do these things:

1. Check their seeing conditions.

2. Get the most out of present lighting equipment.

A booklet, "Sight for Victory" and a time-saving light-sight check sheet has been prepared by the National Better Light-Better Sight Bureau. If you haven't heard about it, write for further information to National Better Light-Better Sight Bureau, 420 Lexington Avenue, New York, N. Y.

GENERAL ELECTRIC

HOW TO ERECT AND TAKE DOWN HIGH POLES

By H. E. STAFFORD, Electrical Engineer, Port Arthur, Ont.

Following methods were used to raise poles for airport obstruction lighting under conditions such as (1) inability to obtain a skilled crew for a "short" job, (2) erection in swamps or other inaccessible locations, (3) difficulty in handling poles because of their length and diameter and (4) proper equipment not being available:

Poles up to 95-ft. lengths and 28-in. diameter butts were erected in muskeg, quicksand, water and heavy clay. Practically all poles were 70-ft. Western cedar; extra length was obtained by splicing (Fig. 1) with straight grained spruce cut at the site. They were stepped before raising and given two coats of paint after raising and drying out.

In raising a 95-ft. pole in quicksand the various steps taken before blowing the hole are shown diagrammatically in Fig. 2. Two tractors were used, one to prevent the butt from slipping ahead, the other to raise the pole. A snatch-block was hung on a nearby tree and the top of the pole raised to a 15-deg. angle with the ground, where it rested on a pole-horse. The fuse was ignited, the hole blown and the pole raised immediately, the butt dropping to a depth of 7 ft. before settling.

Owing to field improvements obstruction-light lines on eight 85-ft. poles had to be moved 1,000 ft. in November, when there was 2 ft. of snow on the level and the ground frozen to a depth of 6 in. The poles were in 7-ft. holes, were cribbed with from one to three cubic yards of rock per pole and lifted as shown in Fig. 4.

Rock was removed from the base of the pole to a 2-ft. depth, to allow one wrap of ¾-in. steel cable. A section of 20-in. diameter log was blocked so it could roll, but not move, from the pole butt. The lifting cable was attached to tractor No. 1, while the lowering cable was attached to the other, both tractors facing the pole to be lowered.

Hand lines were snubbed at right angles to the line and 180 deg. from the second tractor to hold the pole four ways while being lifted. Poles were lifted a foot at a time and all lines adjusted. As soon as the pole butt cleared the hole, as indicated in Fig. 4, the pole was carefully lowered. The lowering of all eight poles was completed in ten hours with a crew of fourteen men, including two tractor drivers.

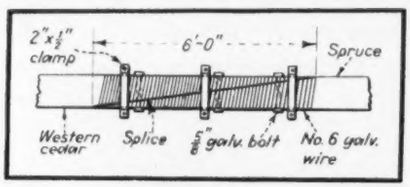


FIG. 1—Splice for spruce extension to Western cedar pole is 6 ft. long, pitched with asphaltum, bolted with three ⅝-in. crossarm bolts, wrapped with No. 6 galvanized iron wire and painted. Three 2x½-in. bands were placed around the splice to add further strength

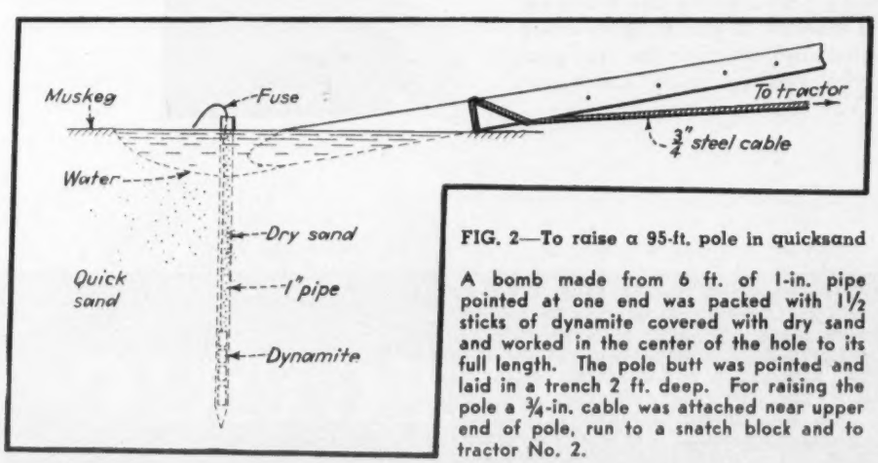


FIG. 2—To raise a 95-ft. pole in quicksand

A bomb made from 6 ft. of 1-in. pipe pointed at one end was packed with 1½ sticks of dynamite covered with dry sand and worked in the center of the hole to its full length. The pole butt was pointed and laid in a trench 2 ft. deep. For raising the pole a ¾-in. cable was attached near upper end of pole, run to a snatch block and to tractor No. 2.

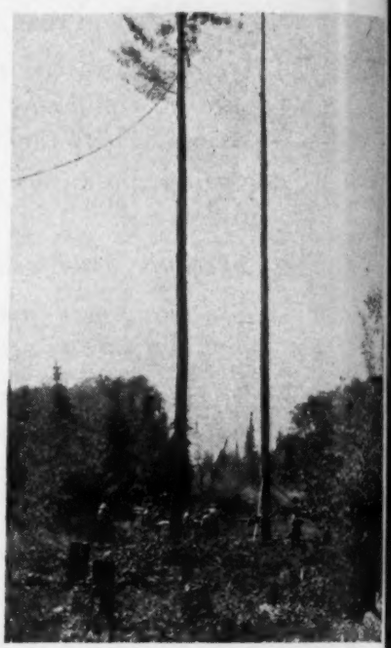


FIG. 3—Pole is raised. Various hand lines, ¾-in. steel cable for hoisting, and grounded pikes can be seen

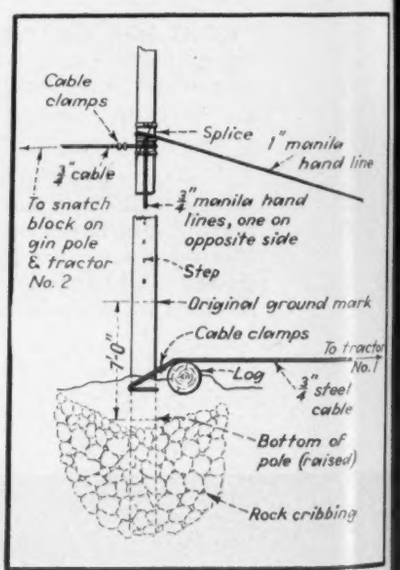


FIG. 4—Arrangements to remove poles from rock cribs and to lower them for use again in relocating line

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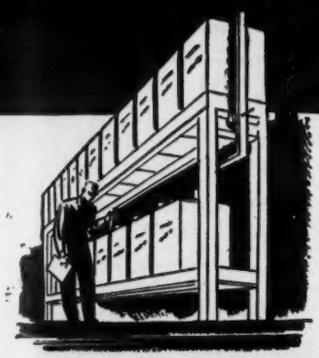

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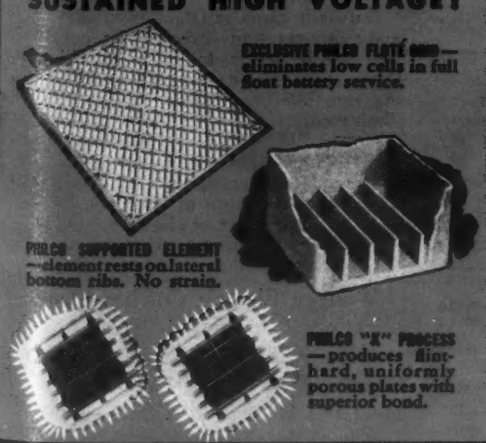

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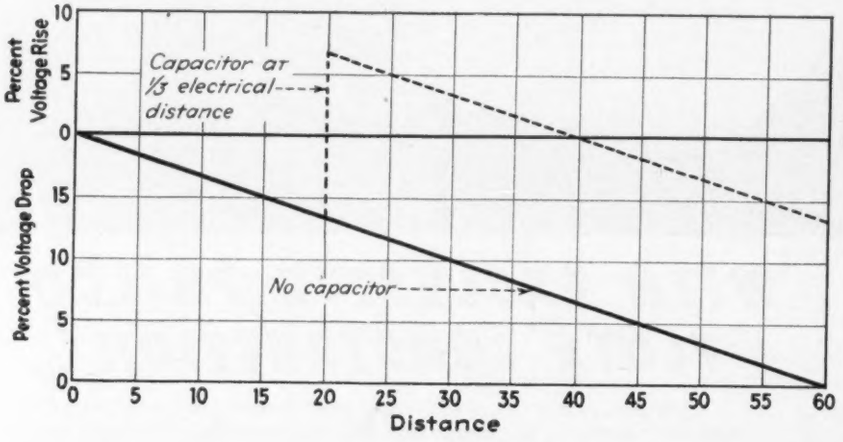
REPLACE WITH RUGGED, HIGH-CAPACITY PHILCO BATTERIES

Series Capacitors—Where Place? How Big?

Determining Location*—IV

By S. LUBIN
Engineer, REA Technical Standards Division

Location of a series capacitor will depend on what is considered acceptable voltage variation on the system. If 10 percent voltage variation is considered acceptable, regulation must be applied to the system at some point near one-third the electrical distance along the line. When the voltage gradient on the system is constant it is recommended that the capacitor be placed one-third the electrical distance between the source and end of the line. This would provide the best regulation (see figure), where the capacitor is applied so that the drop or rise at no point exceeds one-third the total uncorrected drop. However, when large loads or taps are taken off the system at various points the location must be determined by cut-and-try methods with reference to the voltage gradient diagram.



BEST LOCATION of series capacitor is at one-third the total electrical distance unless large loads are taken off at miscellaneous points

In the system shown in the preceding installments, in order to limit the variation to 10 percent at K it would be necessary to decrease the full load voltage drop by about 10 percent.

A first choice for the capacitor location might be some point between E, where the variation approaches the 10 percent limit, and the end of the line. When this point has been decided upon the reactance of the capacitor should be determined as outlined in the following section. Then the voltage rise at light load at the capacitor should be calculated and another voltage gradient diagram drawn showing the variation with the capacitor in the circuit.

*This series began in the April 17, 1943, issue of "Electrical World."

•

Lead Coating By Hot Dipping Process

By W. YONKMAN
Engineer, Western Electric Company, Inc., Chicago

A lead-dipping process for coating of iron and steel has been developed as a substitute for the hot dipped galvanizing process, thereby releasing zinc for more urgent requirements. Although the former process is not new, it apparently was not being used commercially on a large scale. The process being used by the Western Electric Company in the hot dipped lead coating of pole line hardware at the Chicago plant is outlined in the following paragraphs.

Cleaning, Pickling Operations

1. Oil is removed from the parts by any suitable means.

2. Rust and scale are removed in a solution of sulphuric acid. A 6 to 12 percent solution containing an inhibitor and operated at approximately 160 deg. F. is satisfactory. Iron content of the acid should not increase beyond 5 percent.

3. Parts are next immersed for ten to fifteen minutes at a temperature of 120 to 150 deg. F. Iron content of this solution should not increase beyond 5 percent.

4. Parts are then immersed in a water solution of zinc ammonium chloride flux at room temperature until they are completely wetted. This solution is made by dissolving five parts of zinc chloride and one part of ammonium chloride by weight in six parts of water. This flux solution should be kept reasonably free of iron sludge at the bottom of the container. Concentration of iron in this solution should not increase beyond 8 percent. It is necessary that the parts remain wet with the flux solution before dipping into the molten lead.

Note: Water rinsing is not to be used after any of the foregoing operations except after the first operation if alkali cleaners are used.

Lead Bath

The bath consists of commercially pure lead and is maintained at working temperature of 690 to 710 deg. F.

No changes in equipment are necessary in converting a hot galvanizing unit to a hot lead dipping unit. Molten zinc may be ladled and is replaced with lead. Then the lead bath is heated to the temperature formerly employed for galvanizing, to float residual zinc to surface for skimming. Frequent skimming is necessary for a few days, and during this period the bath should not be used for coating. When the zinc is removed, the temperature of the bath is lowered to the desired point for lead dipping.

The molten lead bath is covered with a layer of fused zinc ammonium chloric flux. This fused dark liquid layer (minimum thickness of ⅛ in.) is prepared by covering the bath with zinc ammonium chloride crystals and allowing them to melt and fuse at least two hours before dipping operations begin. Replacement of flux is made to prevent areas of exposed metal on the surface of the bath. Such additions are made in small quantities, away from exit end of the pot and in such a way that unfused flux crystals do not come in contact with parts being dipped.

Lead Dipping Operations

Parts are completely submerged in the molten bath, being passed in and out through the flux several times to insure contact of all the parts with the flux. They are then submerged in the bath or allowed to float until heated to the temperature of the bath. Immediately before withdrawal, they are again passed several times through the molten flux until completely coated.

Immediately after removal from the bath, excess metal is removed by shaking or centrifuging. Then the parts are quenched in hot water and removed quickly from the water to expedite drying. Parts not completely coated may be reprocessed without removing the coating already on the parts, by beginning with the hydrochloric acid dipping operation.

The bath gives satisfactory results after being in operation several days and from then on it seems to improve with use. There are no losses of metal due to dross and the time required to remove dross is eliminated.

Weights of coating produced vary between 30 and 200 milligrams of lead per square inch, determining factors are type of parts, temperature of the bath, and degree of centrifuging or shaking. Lead coatings, in general, are somewhat thinner than zinc coatings produced by hot dipping.

Western Electric Co. has filed application for United States patent covering this process, but in the interest of conservation of certain metals it is its desire that all manufacturers be free to use this process during the war in so far as any patents or applications owned by the Western Electric Co. are concerned.

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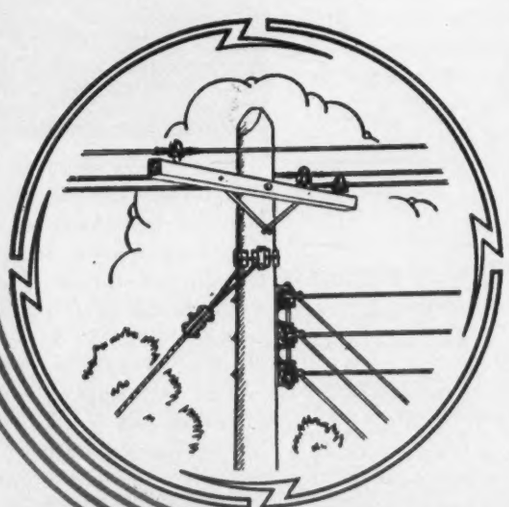

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How Kvar Losses Can Be Minimized

By R. M. SENSINTAFFAR
Electrical Engineer, U. S. Bureau of Reclamation, Colorado-Wyoming-Nebraska Interconnected System, Casper, Wyo.

Line-charging reactive kva. (kvar.) and low power factors are items which, if not minimized, will add materially to system losses. Consider a simple transmission system (Fig. 1)

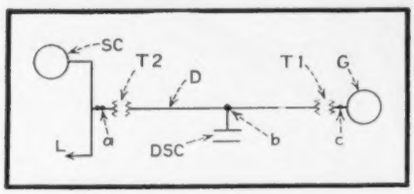


FIG. 1—Transmission system consisting of a 10,000-kva. generator (*G*), step-up and step-down transformer banks (T_1 and T_2), of 10,000 kva. and 70 kw. full-load copper loss each, distributed shunt capacity (*DSC*) of 8,000 kvar., line (*D*) having values of $r = 50$ ohms and $x = 100$ ohms, a 5,000-kva. synchronous condenser (*SC*) and an 8,000-kw. 0.8 p.f. load (*L*)

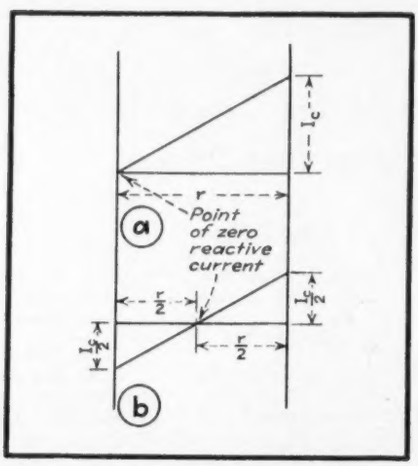


FIG. 2—Reactive-kva. line loss is proportional to charging current and is minimum when both charging current and line resistance are reduced one-half

Table I—Reactive Kva. Distribution

Load Lagging Reactive Kva. = 6,000

Point "a"	Point "b"	Point "c"	Condenser	Generator
+7,000	+3,000	−1,000	+1,000	−1,000
+6,000	+2,000	−2,000	0	−2,000
+5,000	+1,000	−3,000	−1,000	−3,000
+4,000	0	−4,000	−2,000	−4,000
+3,000	−1,000	−5,000	−3,000	−5,000
+2,000	−2,000	−6,000	−4,000	−6,000
+1,000	−3,000	−7,000	−5,000	−7,000

with an appreciable amount of distributed capacities such that it requires an appreciable amount of kvar. to charge the line.

Reactive kva. line loss in kilowatts to the point of zero reactive current for a three-phase transmission system is $0.001\ I^2_c r$, where I_c is the charging current required and r is the ohmic resistance per line to the point of zero reactive current. This is shown in more detail in Fig. 2a.

If the system is operated such that the lagging kvar. at point "a" feeding to the generator is one-half the charging kva. of the line, then the minimum line kvar. losses will be obtained. This is shown in Fig. 2b and is one-fourth of the foregoing equation.

An analysis of a system can be shown by an example. In Fig. 1 the characteristics of the system are given. Table II shows the kvar. losses in the equipment for several distributions of the lagging kvar. between the generator and condenser.

In such an analysis the power factor of the load and the loss characteristics of all equipment will affect the operating point of minimum kvar. loss. Table II shows that for 6,000 lagging kvar. in the load the minimum system kvar. losses will exist when the condenser neutralizes about 1,000 kvar. of the load and the balance of 5,000 lagging kvar. flows

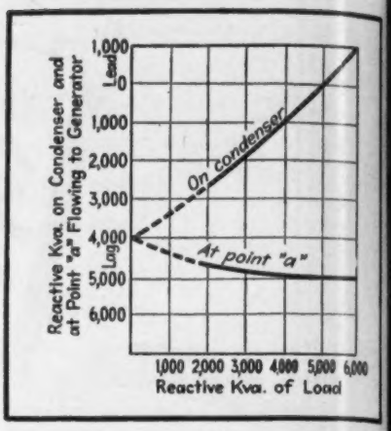
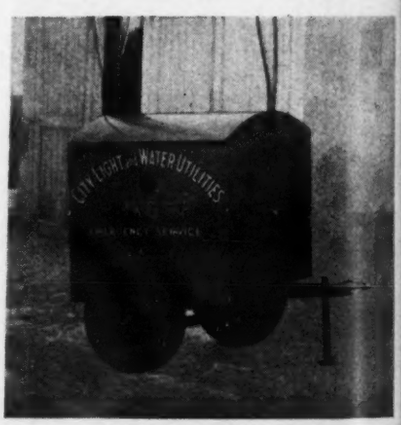


FIG. 3—Relation of load reactive kva. and reactive kva. on condenser and at point "a"

on to the transmission system. By a similar process the point of minimum loss can be obtained for other values of load kvar. Fig. 3 shows this. It will be noted that for this particular system most of the change in the load kvar. is absorbed by the synchronous condenser and that a nearly constant kvar. condition should be maintained between points "a" and "c" for minimum system losses.

•

For Transformer Emergencies



One man, a service truck and this transformer cart restore service in a hurry on the system of the City Utilities, Fort Wayne, Ind., in cases of transformer trouble. The cart houses a 25-kva., 2,400/120/240-volt transformer complete with cutouts and 30 ft. of primary and secondary rubber-covered cable. Lamps behind red glass-windows in the sides and ends of the housing warn off the inquisitive when the unit is operating. It is also used in routine transformer change-outs.

Table II—Reactive Kva. Losses

Load Lagging Reactive Kva. = 6,000

Kvar at "a"	Condenser [1]	Transformers [2]		Line [2]	Generator [2]	Total Loss
		at "a"	at "c"			
+7,000	29.0	34.3	0.4	53.7	1.0	118.4
+6,000	38.0	25.2	2.8	35.0	3.0	104.0
+5,000	47.0	17.5	6.3	23.7	7.0	101.5
+4,000	62.0	11.2	11.2	20.0	13.0	117.4
+3,000	82.0	6.3	17.5	23.7	20.0	149.5
+2,000	107.0	2.8	25.2	35.0	29.0	199.0
+1,000	140.00	0.7	34.3	53.7	39.0	267.7

[1] Total loss.
[2] Prorata of copper loss from kvar. (core loss and load loss in transformer, line and generator are charged to load loss rather than to kvar loss).

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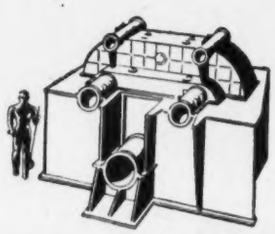

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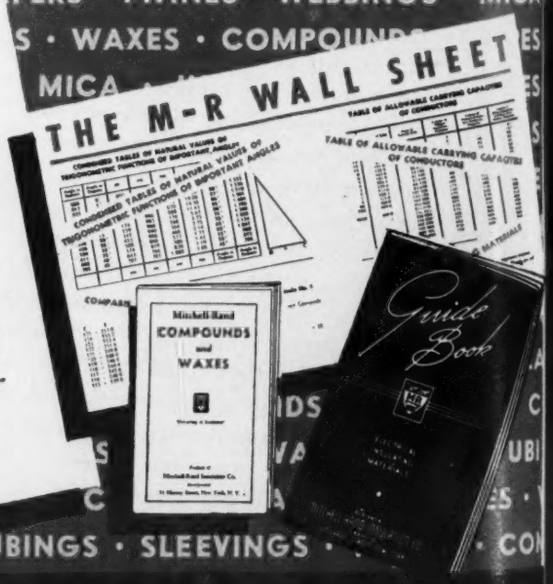
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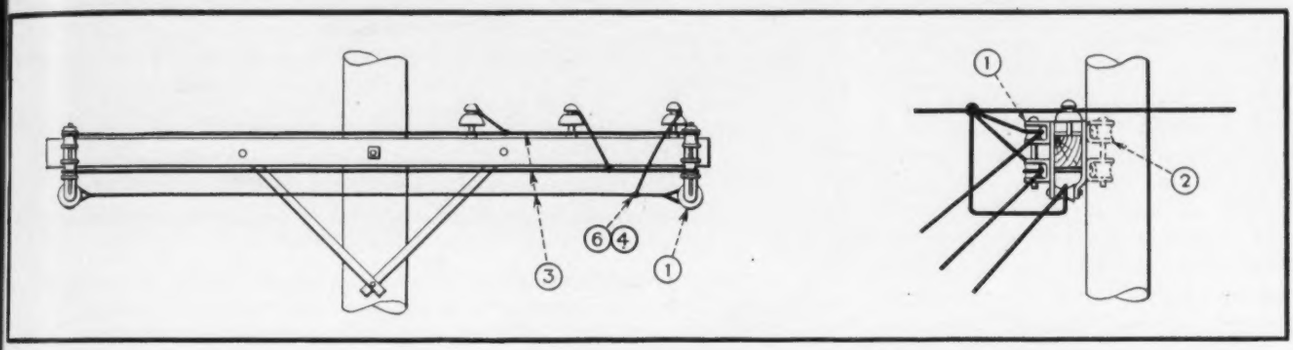
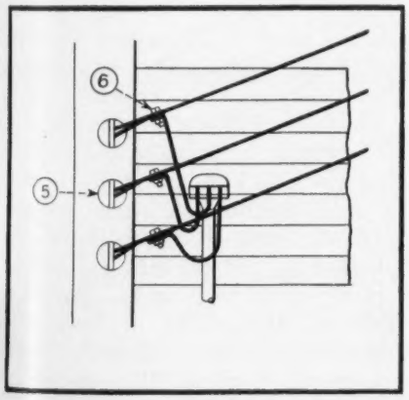
HOW TO ATTACH

OPEN TWO-WIRE AND THREE-WIRE SERVICES

Methods for attaching open-wire services to poles and houses have been standardized by the New England Power System. The company's overhead construction standards are used as the basis for the following instructions, illustrations, and material list



Crossarm attachment



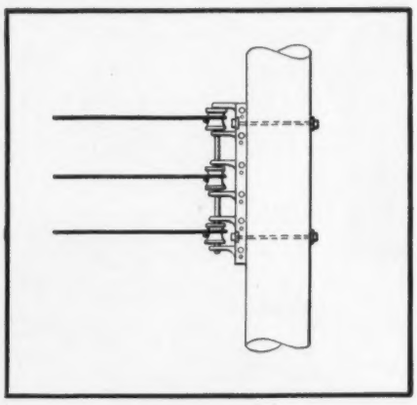
House attachment

LIST OF MATERIAL

(When attachment at pole is on vertical rack omit items 1–2)

Item No.	Description	Amount	
		2-Wire	3-Wire
1	Spreader rack (3-wire) preferred	1	1
1a	Spreader bracket (3-wire) optional	..	(1)
1b	Spreader bracket (2-wire) optional	(1)	..
2	Extension spreader rack	*	*
3	T.B.W.P. wire	*	*
4	Solderless connectors, No. 6	4	6
5	Service bracket	2	3
6	Friction tape	*	*

*As required.



Rack attachment

NOTES

(A) When secondaries and services are on the same side of the pole omit crossover wires and one rack.

(B) Three service wires, No. 6 maximum, may be installed per spool on vertical racks and spreader racks and two wires per insulator on spreader brackets.

When service attachment cannot otherwise be properly made, install extension spreader rack or additional spreader bracket or vertical rack.

(C) On transformer and junction poles the crossover shall be made with three-conductor concentric service cable.

Instrument Analyzes Governor Performance

By A. F. SCHWENDNER
Control Engineer, Westinghouse Electric & Manufacturing Company, South Philadelphia, Pa.

Measurement of performance characteristics of the many types and sizes of steam turbine governors requires a versatile instrument with parts that can quickly be adapted to each case without major alterations to measure these quantities: angular velocity or speed of the turbine rotor, travel of the governor and servo motors, hydraulic pressures of oil governors corresponding to motions in the fly ball governors, and electrical output of the generator. Each quantity requires a separate element capable of wide ranges of adjustment. An instrument (Fig. 1) capable of obtaining all the governor performance characteristics has been developed by the Westinghouse Research Laboratories.

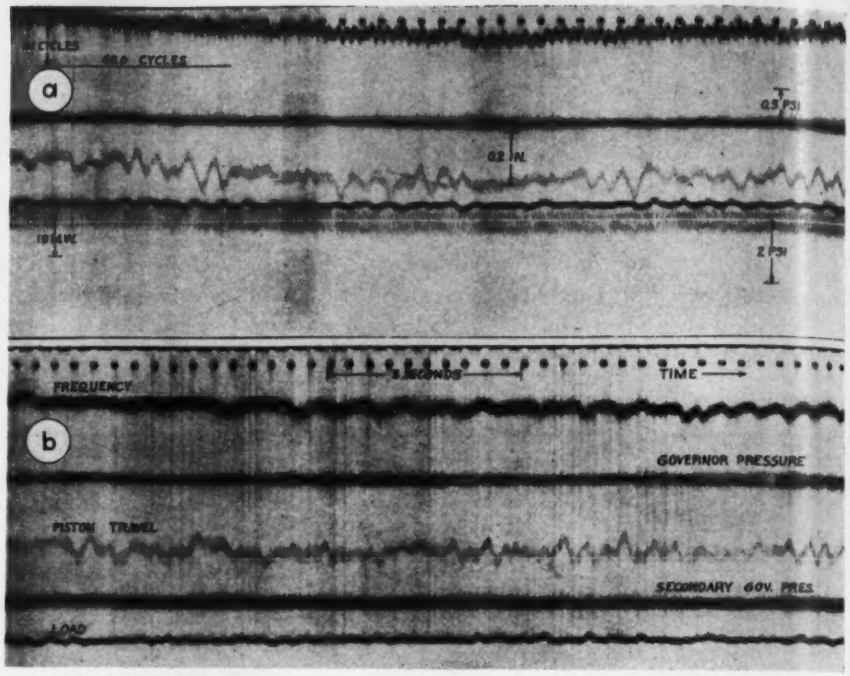


FIG. 2—Typical oscillographic records of frequency, governor pressures, piston travel and load for (a) 25 megawatts and (b) 42 megawatts of turbo-generator load

Four basic elements are used. Speed measuring elements consist of two inductor generators mounted on a common shaft and driven either directly from the main shaft of the unit, or through a small synchronous motor connected through the instrument transformers to the generator terminals. Using one inductor generator will give full scale deflection for a frequency change from 50 to 70 cycles per second. Using the second generator a small frequency change of plus or minus 0.25 cycle will give full scale deflection. The sensitive range generator, having a nominal frequency of 2,400 cycles per second, has in its circuit a highly stable oscillator whose frequency (2,340 cycles per second) is constantly checked through a cathode-ray tube, by means of a Lissajous figure against the frequency of a very stable 234 cycle-tuning fork.

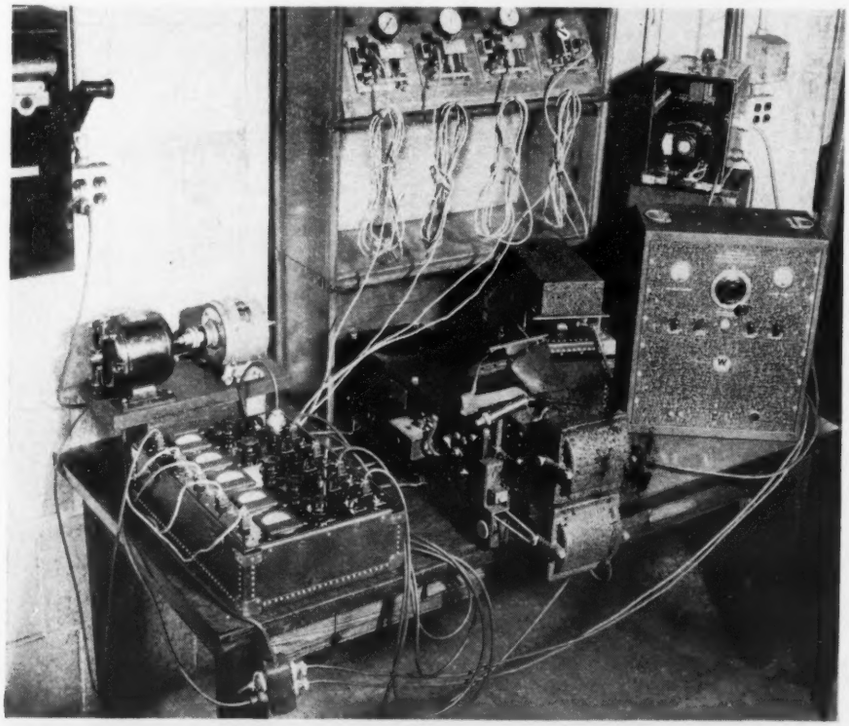


FIG. 1—Complete instrument arranged for governor testing
Motor-driven high-frequency generator and control box for strain gauges at left. Strain gauges (top) include three pressure elements and one motion element with cables to connect to governor elements. A beat frequency of 60 cycles is given by combining the frequency of the oscillator (2,340 cycles) with the output of the second generator (2,400 cycles).

Governor or valve travel measuring element is actuated by a steel wire attached to the governor or valve and wrapped on the pulley of the element so that the free end can be spring-loaded to insure accurate following. Motion of the pulley is transmitted to a magnetic strain gauge which gives full scale deflection with a motion of a governor or valve of 0.2, 0.5, 1.2, 4 and 8 inches.

Pressure measuring element has a bellows to apply the oil pressure. Pressure in the bellows is biased by a calibrating spring through a lever that also actuates the magnetic strain gauge. As the calibration of one element cannot be changed, a number of different elements with a wide range of calibrations are provided. Wide changes in the mean pressure can be adjusted by changing the tension of the biasing spring.

Generator output measuring element consists of a standard poly-

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WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them ... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

49225

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

Company .....

Address ..... City .....

5L

phase average value oscillograph galvanometer wattmeter to measure true watts in three-phase circuits. Output of the speed-, travel-, pressure- and load-measuring elements is taken to a seven-element oscillograph so that all the values required to analyze a governor's performance are placed on a single film or paper.

All the elements of the governor analyzer, except the direct connected induction generators, can be attached to a unit while in operation. The complete instrument can be set up and calibrated in about three hours.

Instruments can be attached while the turbine unit is brought up to speed to carry maximum load. With the instrument in operation (intermittently) the load is reduced in small increments on the load-limit device, which means that the governor is then not speed responsive. Hence, all records are stable and can be taken at specified steam conditions. When zero load is reached the unit is taken off the line. The governor's steady state over-all regulation is then checked with the instrument.

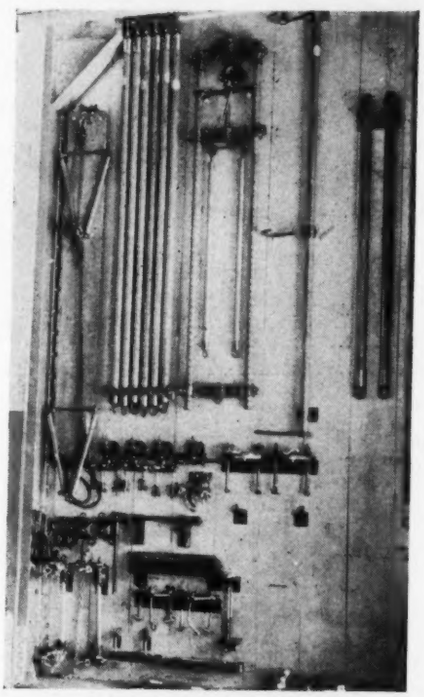
While resynchronizing the unit the instrument is run again to obtain information about the governor's stability. When on the line the load is brought up with the same load increments as before, but with normal speed governor control. The records taken will be similar to Fig. 2 and establishes the dead band, operating incremental regulation and allows a check on the steady state incremental regulation obtained with the first series of tests.

The governor's dead band can be checked at each load point and the operating incremental regulation can be roughly established. After the unit's load has reached the rated load point, a load dump test can be made if desired. This gives the necessary records to analyze all the major governor performance characteristics quickly with one series of tests.

This information is used to establish the actual characteristics and also to indicate improper performance of any part of the turbine-governing system so that its correction will become relatively simple.

•

Hot Line Tool Cabinet

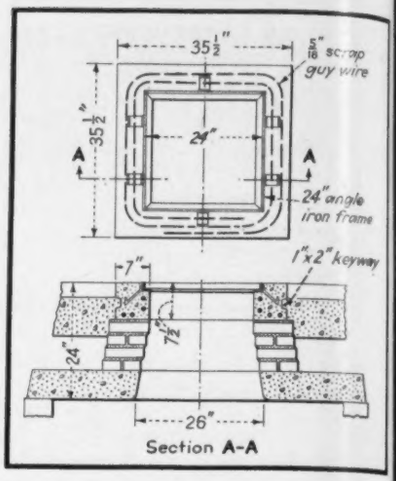


Hot line tools and other heavy construction accessories at the garage of the transmission department of the Union Electric Company of Missouri, Rivermines are stored, when not in use, in huge wall cabinets like the above. Separate cabinets, each 9 x 16 ft., closed off by sliding doors, are provided for the two classes of tools. The place for each device is indicated by a black silhouette of the tool painted on the wall. Each tool is returned to its appointed place when its tour of duty in the field is completed. Similar small cabinets are provided in the company garage for the regular complement of truck maintenance tools and equipment.

Concrete Frame for Manhole

A concrete manhole frame, reinforced with $\frac{5}{16}$-in. scrap guy wire and using a welded angle-iron frame to receive a manhole cover, is being used by the Wisconsin Electric Power Company to conserve iron. Net saving in iron is 193 lb.

The accompanying drawing shows the design of the concrete frame. Scrap guy wire is installed to take care of temperature and frost movement strains. The frame is keyed into the pavement base so that it will move with the pavement during seasonal changes in temperature. It is planned to cast these frames in place



CONCRETE manhole frame for 24-in. square cover saves 193 lb. of iron

as the weight is about 520 lb. The angle-iron frame for the lid is made of obsolete V-angle braces.

•

Movable Glove-Drying "Tree"

It is common practice, for drying rubber gloves, to construct a frame in some part of the shop, usually of 2x4's, in a fixed position. Such a frame takes up considerable valuable wall space and cannot always be situated in the place most convenient to the work. In the City Light shop in Tacoma, Wash., they mount the pins on a movable "hall tree" which can be set in any convenient place while in use and may be moved to an out-of-the-way place when not in use.

WOLFE & MANN at WRIGHT FIELD

BELOW is one of the high-tension, automatic-power transfer cubicles designed and manufactured by Wolfe and Mann of Baltimore for the Air Corps at Wright Field. The Wolfe and Mann Organization is staffed and equipped to give every contract personal attention and expert engineering skill. Ask the folks at Wright Field what they think of the performance and dependability of Wolfe and Mann electrical equipment. Write us about your requirements.

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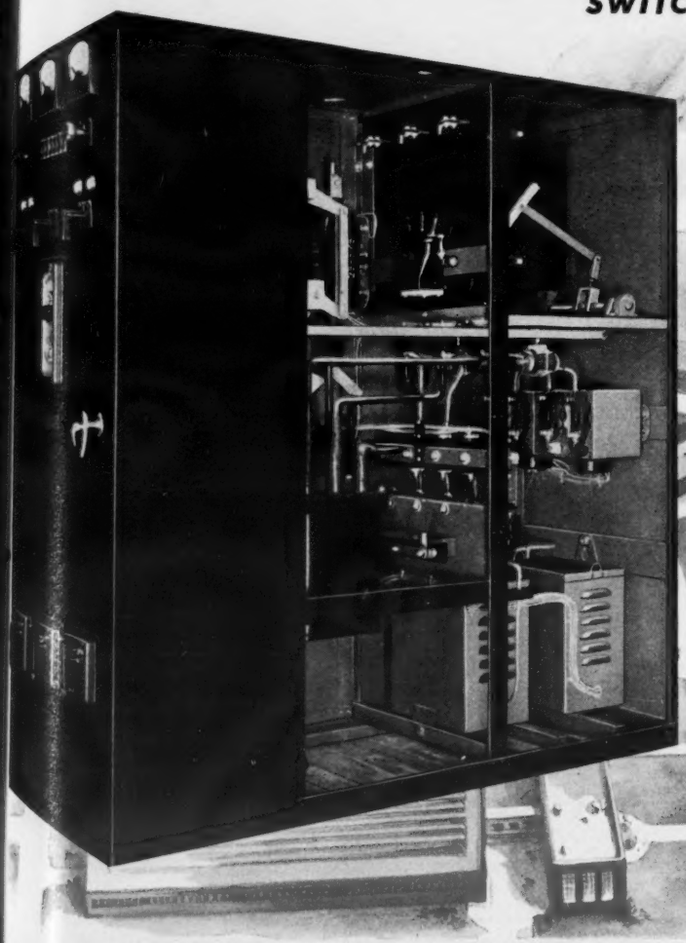
Manufacturing Company

SWITCHGEAR ★ SWITCHBOARDS ★ PANELS

28TH AND SISSON STREETS
BALTIMORE, MARYLAND



These Projects
ARE OUR REFERENCE

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CULPEPER POWER PLANT, CULPEPER, VIRGINIA
NAVY HIGH POWER RADIO STATION, ANNAPOLIS, MD.
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PANAMA CANAL
PEARL HARBOR, T. H.
U. S. TREASURY BUILDING, WASHINGTON, D. C.

HOW TO DETERMINE

SIZE OF THROUGH-BOLTS FOR POLES

By PHILIP MORRILL,
Designer,
Stone & Webster Engineering Corporation, Boston, Mass.

Accompanying tables have been developed for selecting the proper size of through-bolts and double-arming bolts to be used with various kinds, classes and diameters of poles mounting one and two crossarms.

Following references apply to the three tables:

A=Diameter of pole, inches.

B=Length of through-bolt, inches, for one 3½-in. crossarm, gained pole, two washers and nut; for two 3½-in. crossarms, add 4 in. except for those cases marked with an asterisk (*), to which add 2 in.

C=Length of double-arming bolt, inches, for two 3½-in. crossarms.

Lengths of bolts in references B and C are nearest commercial sizes based on 4¼-in. allowance required for each 3½-in. crossarm. For crossarms of other thicknesses add thickness of arm and fitting to pole diameter and use nearest standard-bolt size. In no case should projection of a bolt be more than 2 in.

Ultimate strength of bolt in tension (E.E.I.): for ⅝-in., 12,500 lb.; for ¾-in., 18,500 lb.

Allowable bolt bearing on pole with safety factor of four, pounds per inch of pole diameter

Bolt Size, In.	Tables		
	I-SYP	II-WRC	III-NWC
⅝	780	550	470
¾	940	660	560

Example: 6-in. pole diameter; 6 x 470=2,820 lb. allowance on ⅝-in. bolt.

Table I—Southern Yellow Pine Poles

Pole, Class	Ref.	Distance below top of pole, feet: 0	2	4	6	8	10	12	14	16	18	20	22	24	26
		Pole diameter and bolt length, inches.													
1†	A	9¾	9¾	10	10	10¼	10½	10½	10¾	11	11	11¼	11¼	11½	11¾
	B	14	14	16*	16*	16	16	16	16	16	16	16	16	16	16
	C	20	20	20	20	20	20	20	20	20	20	20	20	20	22
2	A	8½	8¾	9	9	9¼	9½	9½	9¾	10	10	10¼	10¼	10½	10¾
	B	14	14	14	14	14	14	14	14	16*	16*	16	16	16	16
	C	18	18	18	18	18	18	18	20	20	20	20	20	20	20
3	A	8	8	8¼	8½	8½	8¾	9	9	9¼	9½	9½	9¾	10	10
	B	14*	14*	14	14	14	14	14	14	14	14	14	14	16*	16*
	C	18	18	18	18	18	18	18	18	18	18	18	20	20	20
4	A	7¼	7½	7½	7¾	7¾	8	8¼	8½	8¾	8¾	9	9	9¼	9½
	B	12	12	12	12	12	14*	14	14	14	14	14	14	14	14
	C	16	16	16	18	18	18	18	18	18	18	18	18	18	18
5	A	6¾	7	7	7¼	7¼	7½	7½	7¾	8	8	8¼	8½	8½	8¾
	B	12	12	12	12	12	12	12	12	14*	14*	14	14	14	14
	C	16	16	16	16	16	16	16	18	18	18	18	18	18	18
6	A	6	6¼	6½	6½	6¾	7	7	7¼	7¼	7½	7½	7¾	8	8
	B	12*	12	12	12	12	12	12	12	12	12	12	12	14*	14*
	C	16	16	16	16	16	16	16	16	16	16	16	18	18	18
7	A	5½	5½	5¾	6	6	6¼	6½	6½	6¾	7	7	7¼	7¼	7½
	B	10	10	10	12	12	12	12	12	12	12	12	12	12	12
	C	14	16	16	16	16	16	16	16	16	16	16	16	16	18

Table II—Western Red Cedar Poles

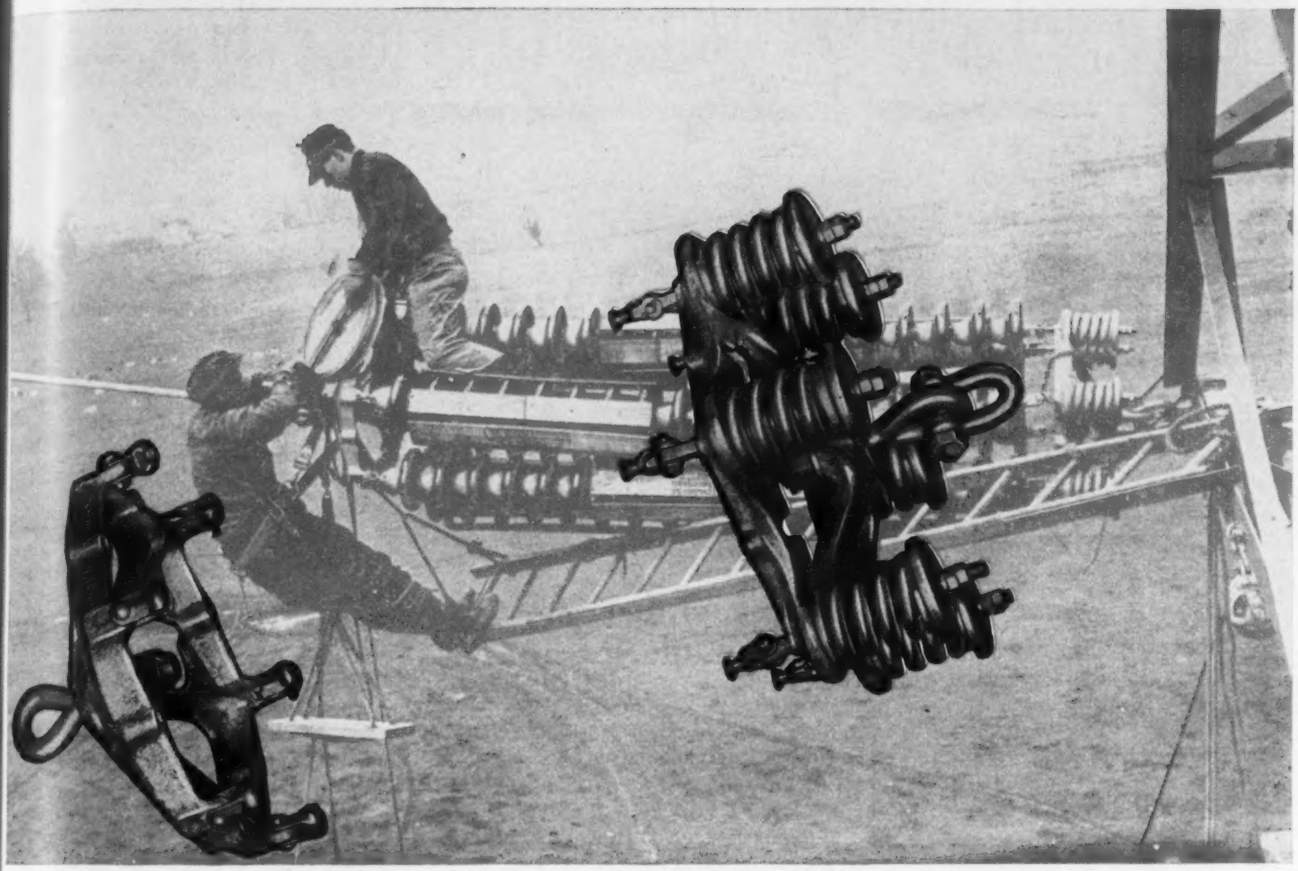
Pole, Class	Ref.	Distance below top of pole, feet: 0	2	4	6	8	10	12	14	16	18	20	22	24	26
		Pole diameter and bolt length, inches.													
1†	A	9½	10	10¼	10½	11	11¼	11½	12	12½	13	13½	13¾	14	14¼
	B	14	16*	16	16	16	16	16	18*	18	18	18	18	20*	20
	C	18	20	20	20	20	20	20	22	22	22	22	24	24	24
2	A	8½	9	9¼	9½	10	10¼	10½	11	11½	12	12½	12¾	13	13¼
	B	14	14	14	14	16*	16	16	16	16	18*	18	18	18	18
	C	18	18	18	18	20	20	20	20	20	22	22	22	22	22
3	A	8	8¼	8½	9	9¼	9½	10	10¼	10¾	11	11½	11¾	12	12¼
	B	14*	14	14	14	14	14	16*	16	16	16	16	16	18*	18
	C	18	18	18	18	18	18	20	20	20	20	20	22	22	22
4	A	7¼	7½	7¾	8¼	8½	8¾	9	9½	10	10¼	10¾	11	11¼	11½
	B	12	12	12*	14	14	14	14	14	16*	16	16	16	16	16
	C	16	16	18	18	18	18	18	18	20	20	20	20	20	20
5	A	6¾	7	7¼	7½	8	8¼	8½	9	9¼	9½	10	10¼	10½	10¾
	B	12	12	12	12	14*	14	14	14	14	14	16*	16	16	16
	C	16	16	16	16	18	18	18	18	18	18	20	20	20	20
6	A	6	6½	6¾	7	7¼	7½	7¾	8	8½	9	9¼	9½	9¾	10
	B	12	12	12	12	12	12	12	14*	14	14	14	14	14	16*
	C	16	16	16	16	16	16	18	18	18	18	18	18	20	20
7	A	5½	5¾	6	6¼	6½	6¾	7	7½	8	8¼	8½	8¾	9	9½
	B	10	10	12*	12	12	12	12	12	14*	14	14	14	14	14
	C	14	16	16	16	16	16	16	18	18	18	18	18	18	18

Table III—Northern White Cedar Poles

Pole, Class	Ref.	Distance below top of pole, feet: 0	2	4	6	8	10	12	14	16	18	20	22	24	26
		Pole diameter and bolt length, inches.													
1†	A	9½	10¼	10¾	11½	12	12½	13	13½	14	14½	15	15½	16	16½
	B	14	16	16	16	18*	18	18	18	20*	20	20	20	22*	22
	C	18	20	20	20	22	22	22	22	24	24	24	24	26	26
2	A	8½	9¼	9¾	10½	11	11½	12	12½	13	13½	14	14½	15	15½
	B	14	14	14	16	16	16	18*	18	18	18	20*	20	20	20
	C	18	18	18	20	20	20	22	22	22	22	24	24	24	24
3	A	8	8½	9	9½	10¼	10¾	11¼	11¾	12¼	12¾	13¼	13¾	14½	15
	B	14*	14	14	14	16	16	16	16	18	18	18	18	20	20
	C	18	18	18	18	20	20	20	22	22	22	22	24	24	24
4	A	7¼	7¾	8¼	8¾	9¼	9¾	10¼	10¾	11½	12	12½	13	13¼	13¾
	B	12	12	14	14	14	14	16	16	16	18*	18	18	18	18
	C	16	18	18	18	18	20	20	20	20	22	22	22	22	24
5	A	6¾	7¼	7¾	8¼	8¾	9¼	9½	10	10½	11	11½	12	12¼	12¾
	B	12	12	12	14	14	14	14	16*	16	16	16	18*	18	18
	C	16	16	18	18	18	18	18	20	20	20	20	22	22	22
6	A	6	6½	7	7½	8	8½	9	9¼	9¾	10	10½	11	11¼	11¾
	B	12*	12	12	12	14*	14	14	14	14	16*	16	16	16	16
	C	16	16	16	16	18	18	18	18	20	20	20	20	20	22
7	A	5½	6	6½	7	7½	7¾	8	8½	9	9¼	9½	10	10¼	10¾
	B	10	12*	12	12	12	12	14	14	14	14	14	16*	16	16
	C	14	16	16	16	16	18	18	18	18	18	18	20	20	20

†Reference for all tables—Class 1 poles may occasionally exceed these values.

Slim and Red DON'T WORRY



Nearly six hundred feet in the air and handling six, eighteen unit strings is a job for steady nerves and experience.

But they're not worrying, and neither are the engineers who o.k.'d the B.T.C. yoke set that equalized all six strings.

Supplying transmission line hardware calls for more than production facilities; it calls for a combined knowledge of your problem and metal working.

We invite any problem in transmission line hardware.

Through Your Insulator Manufacturer Only

B-T-C

Transmission Line Hardware

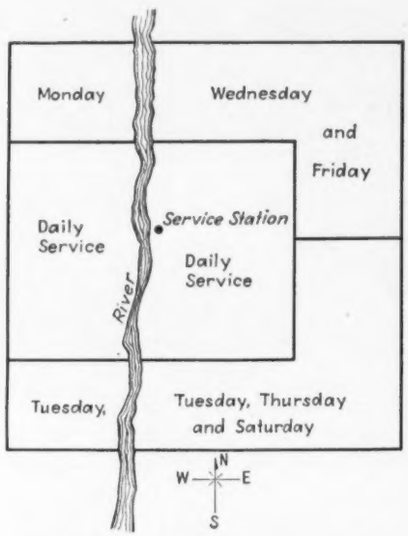
THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Streamlining Service Activities

Working on the basis of a six-man-four-day and seven-man-two-day week, the service department of the Northwestern Electric Company, Portland, Ore., under L. H. Kistler, superintendent of meters and service, has streamlined its service and is getting along satisfactorily.



SCHEMATIC DIAGRAM of territory for ordinary residential and minor industrial and commercial service calls

One help has been to divide the territory roughly as shown by the schematic diagram. Instead of sending out a man to any part of the city every time a call comes in, as in the old days, daily service is now rendered only in a central area around the service station. Outlying districts are served Monday, Wednesday and Friday and Tuesday, Thursday and Saturday. This is for the ordinary run of residential and minor industrial and commercial service. Real emergencies are still served on an immediate or at least daily basis.

Ranges account for a considerable percentage of the residential service. When the call comes, it is ascertained whether or not the situation is serious. If a range is wholly out of service so that no cooking is possible, it may be taken care of on an emergency basis. But if only an element is out or some such matter it must wait for one of the days assigned to that district. This is explained to the resident, who, as a rule, readily understands the necessity and is agreeable to the procedure.

•

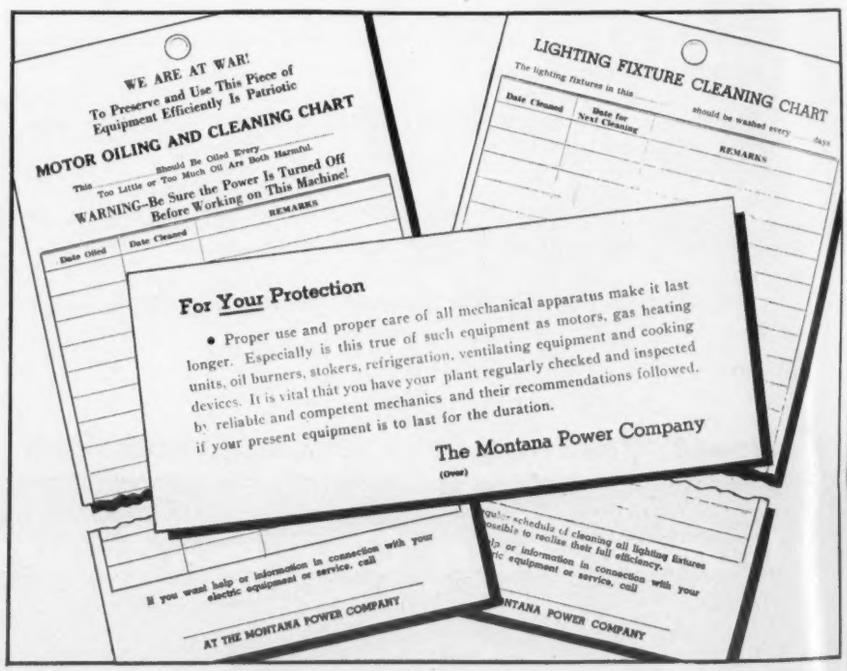
Salesmen Become Equipment Specialists

Commercial and industrial salesmen in all districts of the Montana Power Company have been carrying on an intensive campaign that has two primary objectives. One is to make certain that all mechanical and electrical apparatus is properly used and given proper care. The other is to make a record of all equipment in their territories that is not in regular use and which the owner would be willing to dispose of to some one who could use it. Every plant and commercial establishment where such equipment is installed is visited by the salesman, careful surveys made and the machinery of the plan set in motion and followed up.

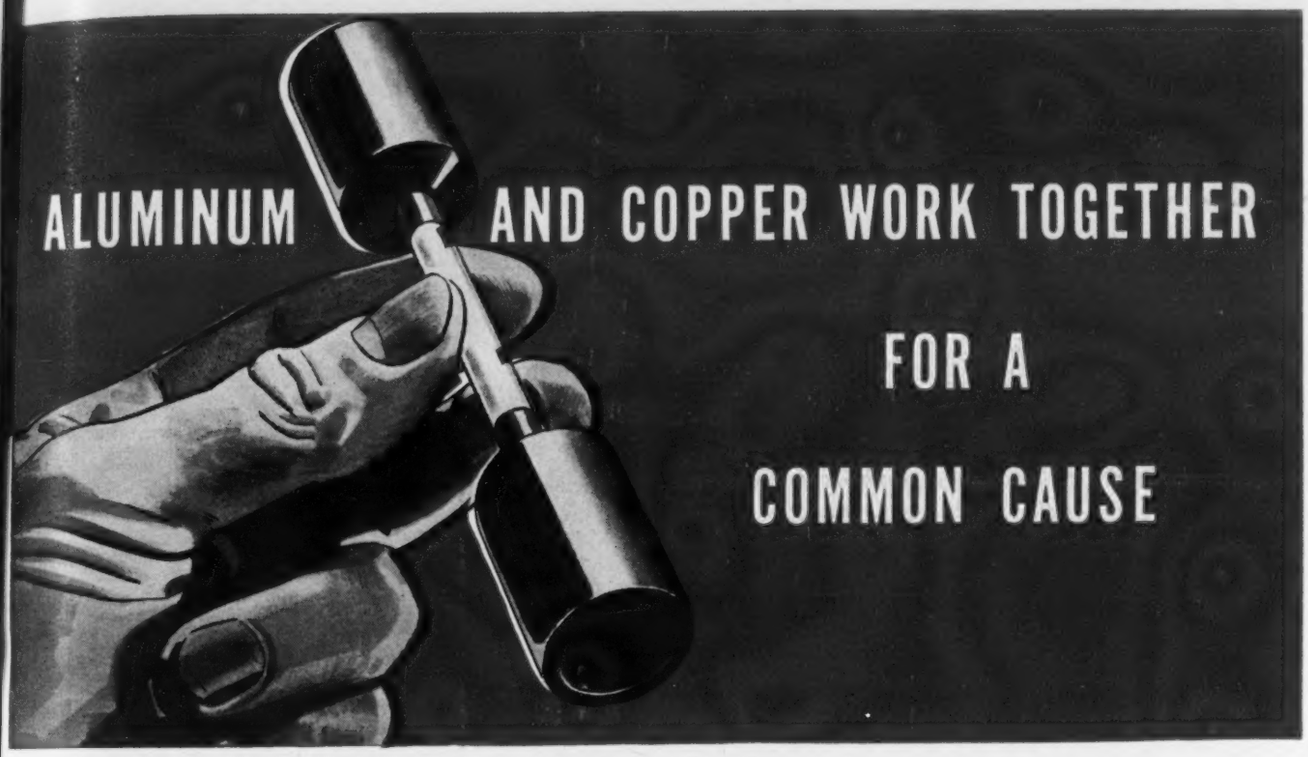
D. J. McGonigle, general sales manager, and R. E. McDonough, commercial supervisor at the home office in Butte, have planned and supervised the work. The general procedure is as follows:

The salesman makes his initial call on the plant and goes through it accompanied by the man responsible for the mechanical equipment, who may also be the service man. Each piece of mechanical and electrical equipment is visited and its condition noted. The salesman provides cards which are hung at each piece. There are spaces at the top for generally defining the equipment and for frequency of oiling. Below are spaces for oiling and cleaning dates that are to be adhered to.

The plant man is asked personally to fill in the spaces at the top and hang the card. A similar card is provided for lighting fixture cleaning. In case the equipment is supposed to be serviced by an outside service man or organization, it is impressed upon the plant manager that this service


WE ARE AT WAR!
To Preserve and Use This Piece of Equipment Efficiently Is Patriotic
MOTOR OILING AND CLEANING CHART
This ____ Should Be Oiled Every ____
Too Little or Too Much Oil Are Both Harmful.
WARNING—Be Sure the Power Is Turned Off Before Working on This Machine!
Date Oiled
Date Cleaned
REMARKS
LIGHTING FIXTURE CLEANING CHART
The lighting fixtures in this ____ should be washed every ____ days
Date Cleaned
Date for Next Cleaning
REMARKS
For Your Protection
• Proper use and proper care of all mechanical apparatus make it last longer. Especially is this true of such equipment as motors, gas heating units, oil burners, stokers, refrigeration, ventilating equipment and cooking devices. It is vital that you have your plant regularly checked and inspected by reliable and competent mechanics and their recommendations followed, if your present equipment is to last for the duration.
The Montana Power Company
(Over)
If you want help or information in connection with your electric equipment or service, call
AT THE MONTANA POWER COMPANY

CLEANING CHARTS supplied by utility salesmen to industrial plants and commercial establishments



This is a fuse link for underground cable, designed by a leading power company and used by many. The small aluminum rod, coupling the two copper sleeves together, has fusing characteristics which make it highly desirable on this assignment. No poisonous fumes to foul cable tunnels. Its melting point is definite.

The assembly is made by flash butt welding the copper end pieces to the aluminum alloy rod. The completed link is installed by soldering the ends of the cable into the copper sleeves.

Thus, aluminum and copper do a task better, here, than either could do it alone. It is a type of cooperation that the postwar world is certain to see a lot of. Alcoa engineers will gladly help you work out any ideas you may have along this line.

A.C.S.R. is a similar example of two metals being employed as a team. Aluminum provides high conductivity, steel gives high strength, an ideal combination for power conductors. Over a million miles of A.C.S.R. in service are evidence of its reliability. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

man be brought in at once and started off on a regular maintenance schedule. It is brought home at the same time that 95 percent of mechanical troubles come from improper care of equipment. Before the next call, which is generally in four or five weeks, a follow-up card is mailed, stressing proper use and care as a protection and to further the war effort.

Upon the second call, it has been found that about 40 percent of the plant managers are following through on a systematic basis themselves, or have employed an outside service man. But if nothing has been done the salesman suggests going in his own car and getting an outside service man, bringing him in and getting him started on the service routine. Experience shows that this pares down about another 40 percent.

Later, another card, which is specifically a motor maintenance card, is mailed.

Unused Equipment

On these calls by the salesman he also systematically goes ahead securing data for the second part of the plan, which is to list unused or little-used equipment. This listing, however, does not include that which is specifically spare equipment. He goes with the plant representative and lists up all facts concerning each unused machine or motor—type, size, serial number, model, speed, phase and voltage of motor, etc. Individual motors not in use on any machine are also listed.

Lists of all such unused equipment for a territory are kept in the utility office in that territory. At the same time the Montana Power Company listed its own usable, idle equipment and threw it into the general pool of possibilities.

In making his calls the salesman talks of many other things besides care and use and listing of unused equipment. He discusses new installation needed, priorities, etc. As a result, the commercial and industrial customers, when they need something that they can't get, or when they contemplate making extensions of plant if they could only get the necessary equipment, are falling into the habit of first taking the matter up with the utility salesman, whom they know by these contacts is making a study of the whole machinery situation throughout the territory.

Mr. McDonough related an instance or two which illustrate how the plan operates. One was a gravel pit where a 75-hp. motor went out which was needed to work at top capacity under good weather conditions. The trouble was referred to the salesman at once. He referred to his list and found that there was one available in a plant 270 miles away, suitable in size. Without waiting to go there, instructions were telephoned to the owner to have the motor loaded on the train and shipped direct. It reached the gravel pit that week-end and was installed and put in operation without losing a shift. From the money standpoint, the transaction was handled by the buyer and seller.

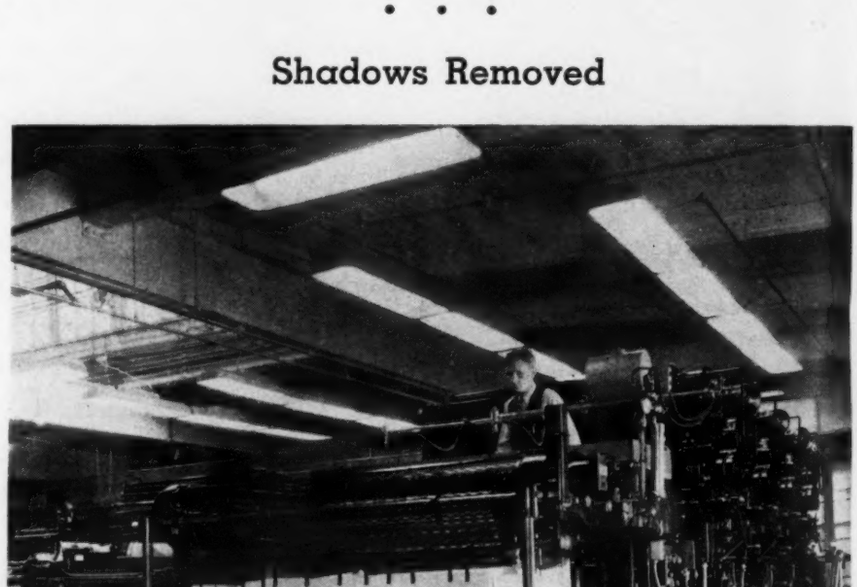
Another example was that of a meat packing plant where a motor burned out on a Saturday afternoon. The plant manager ran down the salesman, who happened to be on a week-end fishing trip. Hastening back, the salesman found his list did not disclose the right type of motor, so he telephoned one of the salesmen of another office. His list did show a suitable one. Contacting the owner, he got it shipped on Sunday and it arrived at the packing plant that evening in time to be installed and ready to run Monday morning, without any interruption of service.

On the Butte, Mont., list alone there are listed 419 motors from 800 hp. down to fractionals. Aside from motors, the items listed run into the thousands.

Examples such as the two above might be cited by the hundreds. The company, however, is distinctly not in the second-hand machinery business. It acts simply as an intermediary without profit. No prices are quoted, no equipment picked up anywhere and put into a stock. All that it does is to bring the two interested parties together and, after they have concluded their deal, check off the piece of equipment whatever it is from the list of "possibles."

• • •

Shadows Removed



Replacement of ten daylight filament lamp fixtures totaling 5,000-watts by ten fluorescent fixtures aggregating 800 watts over a 42 x 58-in., four-color Harris offset press at the plant of the Providence (R. I.) Lithograph Company resulted in shadowless illumination on the plates of this important production unit. In the revised layout four RLM type fixtures were hung by adjustable chains on each side of the press, 6 ft. between the centers of the two rows, and one more fixture was placed at each end, all being 5 ft. 4 in. above the level of the plate cylinder. The tubes are each 4 ft. long and two 40-watt daylight tubes are mounted in each fixture. The end tubes aid in eliminating stroboscopic effects. From 26 to 29 ft.-candles intensity is obtained on the plate cylinder.

Quick Answers

ON SWITCHGEAR APPLICATIONS

Today, when every minute of production time gained brings Victory that much closer, the Westinghouse TWO-FOLD Switchgear Service puts application on a wartime basis. It insures getting the *right* switchgear in the *minimum* time with the *least* expenditure of Critical Material.

1

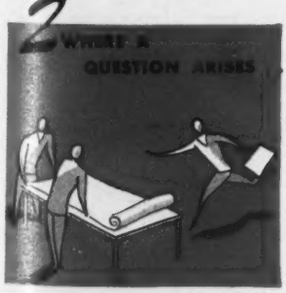
B-3035 Heavy-Duty Oil | B-2273 Light-Duty Oil
B-3036 Heavy-Duty Air | B-2296 Low-Voltage Air

...THESE FOUR BOOKS ON "UNITIZED" SWITCHGEAR

will save 30% of the time usually required to order, build, and install switchgear. Nowhere else can you find so much factual, easy-to-use switchgear information.

To order "Unitized" Switchgear, just (1) select units by number, (2) draw a single-line circuit diagram and specify capacities.

2



...APPLICATION ENGINEERS ARE AT YOUR CALL...

Always at hand to help, is a country-wide organization of Westinghouse Application Engineers and Switchgear Specialists. They will answer promptly all questions on the best way to handle a job. Use them to expedite selection and ordering. You can reach them at your nearest Westinghouse Office.

***"UNITIZED"** switchgear makes expansion quick and easy.* New power requirements can be handled in a fraction of the time previously required. Ordering and manufacturing time are greatly reduced *and installation time has been cut as much as 60%*. Recently, a new unit was added to a "Unitized" Switchboard. Only 6 hours installation time was required instead of the 16 normally required with custom-built switchgear.

Take advantage of this TWO-FOLD Service. Call your nearest Westinghouse Office. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-60528

Westinghouse

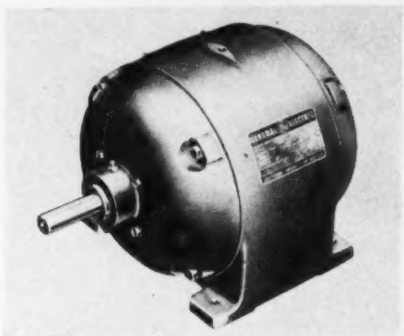
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

"UNITIZED" SWITCHGEAR

NEW EQUIPMENT

Motors

New line of totally inclosed motors has been added to the Tri-Clad group and the units have been designed for use where



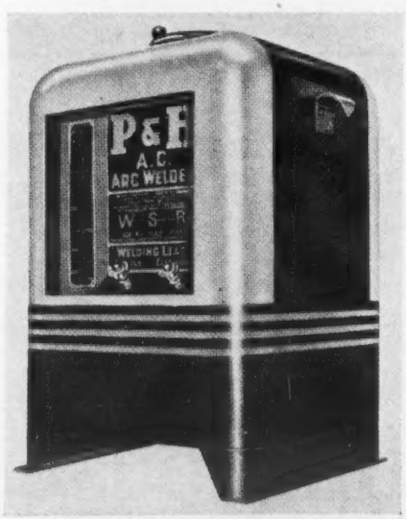
"Tri-Clad" polyphase, 60-cycle induction type (shown,) and single-phase, 60-cycle, capacitor type motors; polyphase frame sizes, 203 to 225; single-phase, 203 and 204; ratings range from ½ hp., 900 r.p.m. to 2 hp., 3,600 r.p.m., for standard voltages. **General Electric Co.**, Schenectady, N. Y.

abrasives, chemicals, rain, snow and excessive dirt are encountered. Frame, end shields and conduit boxes are of cast iron. Leads are permanently incased in compound in a cast-in pocket in the stator frame to prevent liquids from seeping into the motor. Motors are wound with Formex wire.

•

Arc Welders

New line of a.c. arc welders consists of seven heavy-duty and four intermittent-duty models, with range of capacities for handling production welding under continuous operation. Setting and control of current throughout complete welding service range involves one simple, easy-to-operate adjustment, it is said.

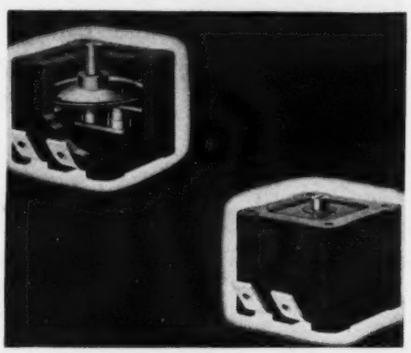


Industrial a.c. arc welders; ratings 12-1,200 amp. welding service range. **Welder Division, Harnischfeger Corp.**, Milwaukee, Wis.

•

Switches

Sealed in Bakelite cases to protect contacts against hazards of dirt, dust, sand and oil, two new switches were designed for an operating pressure of 1½ to 3½ lb. Travel differential is claimed to be 0.006 to 0.012 in. and over-travel is 0.050 to 0.070 in. at maximum pressure. Contact arrangement for type "A3" is normally closed, double break; for type "A5," normally open, double break. Both are single-pole, single-throw switches.



Types "A3" and "A5" sealed switches; capacities, non-inductive, 50 amps. at 12 and 24 volts d.c. and 110 volts a.c.; dimensions, 1 15/16 x 1 15/16 x 1 19/32 in. **The Allied Control Co.**, 2 East End Ave., New York.

•

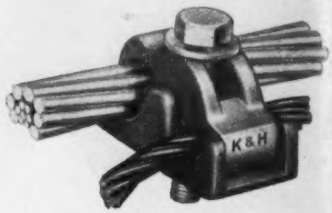
Protection System

Light source, type "L60M" and receiver, type "A30M," photoelectric protection units, with auxiliary latching relay with reset button; operates on 105 to 125 volts a.c. **Photoswitch, Inc.**, 77 Broadway, Cambridge, Mass.

Designed to meet government regulations, photoelectric equipment which is said to project a fence of invisible light over distances as great as 1,500 feet is useful for protection of harbors, yards, industrial properties and other large areas. Instant local or central-station alarm is given if an intruder enters the protected area. In operation, light source is aligned with receiver, to which it focuses a modulated beam of infra-red light. Because the receiver responds only to the frequency of light from the light source, it is claimed not to be affected by other artificial light or by daylight. If invisible infra-red light is not required, the operating range is said to exceed 2,000 feet.

Tap Connector

New connector, constructed of 85 percent copper alloy, is designed so as to make it possible to insert the largest-sized conductors without removing any parts of the connector. It can be used as guy line



Catalog Nos. UC58A, B and C "Universal" tap connector; wire sizes 0.595 in. to 5/32 in. **Krueger & Hudepohl**, Cincinnati, Ohio.

ground, or transformer and lightning arrester connection to ACSR or copperweld conductors where the diameters may be from 8-A copperweld to 0.595-in. ACSR armour rods. Model "A" is cadmium-plated all over, used to connect aluminum to steel guy line or to another aluminum conductor; "B" is one-half cadmium plated, used to connect copper to steel or copper to aluminum; "C" is not plated, used to connect copper to copper.

•

Test Chamber

Model "RTCI-H" humidity test chamber; interior content, 25.9 cu.ft.; humidity range ambient to 140 deg. F., ambient to 90 percent relative; temperature range —55 deg. C. to +70 deg. C. **American Coils Co.**, 25-27 Lexington St., Newark, N. J.

New test chamber has mechanical refrigeration and electric heating, a two-stage Freon condensing unit and an attachment for humidity control. Positive forced air circulation and temperatures with thermostatic control are said to make the device dependable for tests on delicate mechanisms and precision equipment. Observation of products under test is provided by a door having five sealed and dehydrated panels of glass.

•

Gauge

Adaptable to laboratory, shop and field uses, new gauge is said to be individually calibrated and accurate within one gradution mark. It can be used for testing spring characteristics, for measuring the pull of a relay or magneto, for checking the pressure required to operate push-pull button switches, for determining the breaking strength of fibres, and for measuring other forces.

"Push-Pull" instrument type gauge; capacities ½ gram to 100 lb. **John Chatillon & Sons**, 85 Cliff St., New York, N. Y.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

—Like the HUBBARD AUTOGAP Lightning Arrester "Shoots Out" a follow-up arc

In Texas and other oil districts, when a well takes fire, a famous firm of oil field fire fighters is called in to extinguish the blaze. This is often accomplished by "shooting out" the blast after wreckage has been cleared and the fire confined to the smallest possible area, usually the jet emitted from the top of the casing. "Shooting out" consists of placing at the casing, a heavy charge of gelatinous nitroglycerine which, when exploded, destroys contact between the gases and the flames so that the continuous feed of combustible material to the point of ignition is interrupted. There is much more to the trick, but in principle, that is the process.

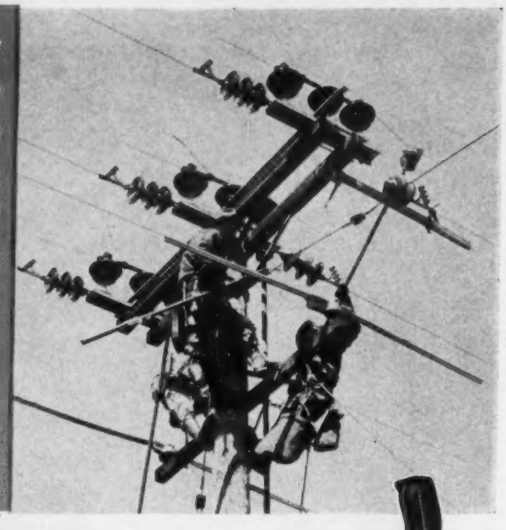
Hubbard *Autogap* Lightning Arresters employ exactly the same principle, but the "fire" in this case, is electrical, and the dissipating force is supplied automatically by the passage of the current through the arrester. When the current is forced around core "A" and through the minute clearances "B" to reach ground, the confinement and the contact with the fiber surfaces causes an explosion. The gases generated are exhausted simultaneously in opposite directions through vents. The follow-up arc is "shot out" just as the nitroglycerine explosion snuffs out a burning oil well.

For detailed data and diagrams write for an illustrated "Autogap" bulletin containing operating data, installation methods, results of tests and other pertinent information.

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

..Only a few minutes are required to make dead-end insulator changes "hot" with this TIPS tool...



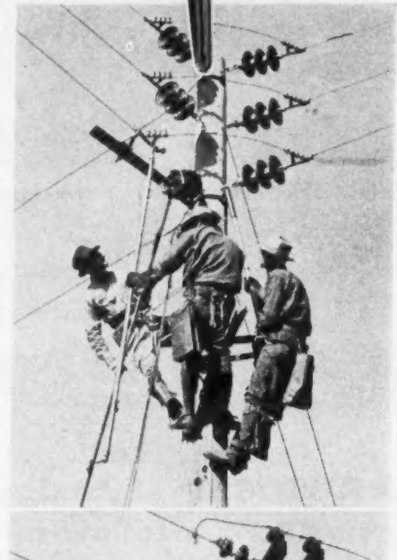
Crews can average less than 15 minutes per string by this simple method:

When broken dead-end insulators appear on voltages up to 33KV this Tips Strain Carrier provides a quick, easy method for replacing them without interrupting service. To install this type strain carrier simply adjust it to the desired length and slip the socket end on the conductor (On 33KV lines the socket end should be lifted into place by a Grip-All or disconnect stick attached to the eye screw) slide it into place over the insulator clevis, hook the other end into the back of the pole or cross arm and take up slack with the ratchet wrench.

When the strain is relieved from the insulators the cotter keys may be removed with a cotter key remover fitted on the end of a Tips Universal (insulated) Pole. When keys are removed the broken insulators may be lifted free with a fork-like tool designed for that purpose (see photos) and new insulators may be replaced by the reverse procedure. When cotter keys are replaced, using the key replacer, let off the slack by reversing the ratchet wrench and remove the strain tool from the line.

On the switch structure (above) insulators, in four strings, were changed in fifty minutes. The average time on the dead end corner (second photo) was ten minutes per string.

The lower photo shows the strain carrier being used with a Cumalong where a tap clamp was too close to the clevis.



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ABC INDUSTRIES

TECHNICAL LITERATURE

"INDUSTRIAL FIRE BRIGADES" is a 184-page volume designed for use as a training manual for employees, as a reference book, and provides essentials but not the details of large plant fire protection organization. The book, with 8½ x 11-in. pages and numerous illustrations, has 16 chapters covering subjects such as organization, fire-fighting procedure, practices, electrical fires, salvage, and period inspections of equipment. Copies may be obtained from the publishers National Fire Protection Association, 60 Batterymarch St., Boston, Mass.; price $1.50 each postpaid.

CRANES—Booklet "How to Operate a Crane" has been issued as an aid in training new employees as well as being beneficial in improving the quality of performance from the more seasoned operator. It passes along hints, tips, cues and safety rules, describes and shows by nearly 70 illustrations the various steps in crane operation. Booklet 920 may be obtained from The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland, Ohio.

PLASTICS—"Designing Molded Plastics Parts" is a 16-page booklet covering technical subjects such as materials, physical properties, chemical and thermal properties, electrical properties, assembly devices. Copy may be obtained from Plastics Department, General Electric Co., Pittsfield, Mass.

FAULT LOCATION—Methods for locating faults on telephone and telegraph cables, for measuring conductor resistance for locating grounds and crosses by Murray, Varley and Hilborn loop tests, and for locating opens by capacitance tests are exemplified in Cat. E-53-441(1), "Type U Test Set." Copy of the booklet may be obtained from Leeds & Northrup Company, 4934 Stenton Ave., Philadelphia, Pa.

MINE LOCOMOTIVES — Operating tips; trouble checks; inspection reports; inspection charts, covering all principal parts of locomotives, and a lubrication chart for typical mine locomotives are outlined in a 33-page booklet "Time Saver." The booklet No. B-3150 may be obtained from Dept. 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ARC WELDING — Contents of bulletin "Maintenance of Farm Implements by Arc Welding" represent a digest of welding techniques and procedures to keep farm equipment in good repair. A total of 47 photographs and illustrations are reproduced. Copy of Bulletin 433 may be obtained from The Lincoln Electric Co., Cleveland, Ohio.

PLASTICS—Mechanical, thermal, optical, electrical, and other properties for Lucite, Plastacelle, Pyralin, Nylon, and Butacite, also a listing of definitions of properties are contained in an 8-page booklet, "Engineering Highlights About du Pont Plastics," made available by Plastics Dept., E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

"PROLONG INSTRUMENT LIFE" is title of an article outlining steps on care of instruments in plants, regardless of the make of instruments used. The article appears in Wheelco Comments, Vol. 2, No. 5, made available by Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

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1. AMERICAN ELECTRICIANS' HANDBOOK

This famous handbook is packed with the facts which every man engaged in electrical work must have constantly at hand. From clear explanations of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information helps practical electrical men select, install, operate, and maintain commercial electrical apparatus and materials efficiently. By Terrell Croft, revised by Clifford C. Carr. 1600 pages, $5.00.

2. STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS

The greatest standard reference work of all in the electrical engineering profession. Presents a handy compilation of practical, usable data from all fields of electrical engineering practice, plus the most frequently required fundamental theory, units, and systems of measurement, made dependable by the work of more than 100 engineers, scientists, teachers, and other authorities. Prepared by a staff of specialists. Archer E. Knowlton, Editor-in-chief. Associate Editor of *Electrical World*. 2303 pages, $8.00

3. FRACTIONAL HORSEPOWER ELECTRIC MOTORS

Here is a systematic presentation of descriptions, data, and diagrams for 18 major types of fractional h-p electric motors, for practical use by all who are concerned with the design, manufacture, use, and repair of these motors. Tells what kinds are available, what makes them run, and how to repair, rewind, and reconnect them. By Cyril G. Veinott, Westinghouse Electric and Manufacturing Co. 331 pages, $3.50.

4. TRANSFORMER PRINCIPLES AND PRACTICE

A practical engineering treatment for the average electrical man concerned with transformers, covering their underlying principles, construction, testing, connection, and operation. Mathematical theory is avoided, and various special types and applications of transformers are included, such as autotransformers and phase changing. By J. B. Gibbs, Westinghouse Electric and Manufacturing Co. 210 pages, $2.50.

5. TROUBLES OF ELECTRICAL EQUIPMENT

This book gives the electrical worker practical pointers on how to locate, diagnose and remedy electrical equipment troubles quickly and accurately. Covers the symptoms, causes, and remedy of troubles of both a-c and d-c apparatus usually found in the average industrial plant, for men in construction, operation, or maintenance. By H. E. Stafford, Consulting Engineer. 373 pages, $3.00.

6. FLUORESCENT LIGHTING MANUAL

This practical manual covers fluorescent lighting in all its aspects in an easy-to-understand manner. Gives the most authoritative data available on construction and performance of all types of fluorescent lamps, principles and methods of calculating illuminating requirements and designing luminaires, and of installing and maintaining fluorescent lamps. By Charles L. Amick, General Electric Co. 312 pages, $3.00.

7. ELECTRIC DISTRIBUTION FUNDAMENTALS

This book shows how to solve the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution. From a non-engineering viewpoint, it outlines the features of both utility distribution and the industrial and inside wiring branches of service to the outlet. By Frank Sanford, Cincinnati Gas and Electric Co. 242 pages, $2.50.

8. WINDING ALTERNATING-CURRENT MOTOR COILS

Presents as simply as possible practical information that will enable engineers and repairmen to modernize older types of a-c motors and generators by redesigning and rebuilding their windings as well as to replace burned-out or defective windings in present-day designs. Explains and illustrates the best methods of designing, laying out, winding, and insulating coils used in single and polyphase a-c motors. By G. A. Van Brunt, Associate Editor, *Factory*, and A. C. Roe, Westinghouse Electric and Manufacturing Co. 281 pages, $3.00.

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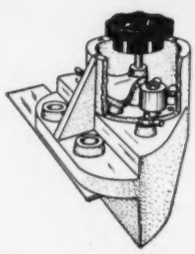
NOW THERE'S A POCKET!

★ That's what a utility man exclaimed when he saw the high voltage pockets on our new E.E.I.-NEMA Standard Distribution Transformers. The truth of the matter is, we're proud of these pockets. Large, bullet-shaped, they protrude beyond the bushings and protect the bushings against injury while the transformer is being shipped, stored, or delivered.

CIRCULAR COILS

The tension in each turn of wire can be carefully controlled because Pennsylvania coils are Circular and are wound as individual units. Pennsylvania Circular coils are balanced radially and axially against short circuit stresses.

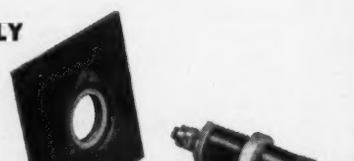


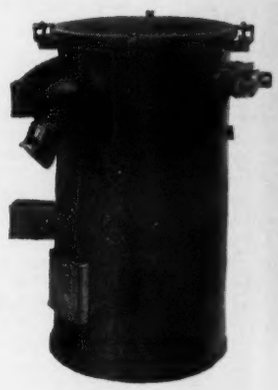
NEW TAP CHANGER

Porcelain barriers separate individual leads brought into the tap changer. A heavy porcelain skirt on the tap changer extends over the core clamping frame to which the tap changer is bolted, and prevents the leads from contacting the core frames and becoming grounded.

LOW VOLTAGE BUSHING ASSEMBLY

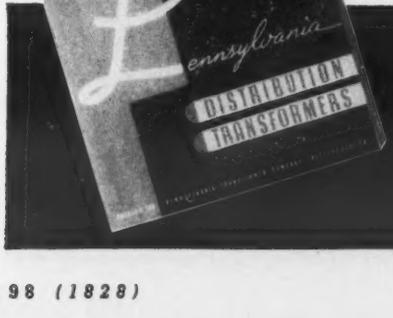
The low voltage bushing is bolted to the tank by placing the bushing shoulder under compression. (This is the proper way of bolting porcelain.) Bolts in the clamping structure are easily removed by a screw driver. Everdur screws will not rust in the holes. Cork gasket is completely protected from the weather.





DISTRIBUTION TRANSFORMER

Exterior of typical 1½ to 25 Kva. Standard Distribution Transformer. Single Phase, O.I.S.C., 60 Cycles, 2400 volt pocket type bushings on High Voltage. Low Voltage rated 120/240 volts with horizontal stud type bushings.



Standard transformers available in sizes up to 150 Kva.
Write for our new catalog on Distribution Transformers.

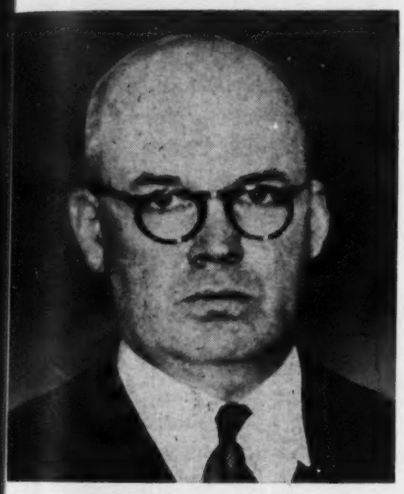
Pennsylvania
TRANSFORMER COMPANY
PITTSBURGH, PENNSYLVANIA

Pennsylvania TRANSFORMERS

NEWS ABOUT PEOPLE

G. H. Flagg Made Oregon Utilities Commissioner

George H. Flagg of The Dalles, Ore., has been appointed Public Utilities Commissioner by Gov. Earl Snell. Mr. Flagg, who replaces Ormond R. Bean, has served as chief deputy secretary of state since 1934. Prior to entering



G. H. Flagg

public life Mr. Flagg owned and operated newspapers at The Dalles, Condon and in other eastern Oregon cities.

Mr. Bean, an architect, was elected a Portland city commissioner in 1932 and appointed by Governor Sprague in May, 1939, as utilities commissioner. He was the first engineer to hold this position.

•

▶ PAUL B. MCKEE, president of Pacific Power & Light Co. and Portland Gas & Coke Co., Portland, Ore., has been appointed vice-president and a member of the board of directors of the Rubber Development Corp., a newly formed RFC subsidiary, which has taken over all phases of the natural rubber program in this country under William M. Jeffers, rubber director. The Rubber Development Corp. has assumed the problem of getting natural rubber from the upper Amazon jungles of Brazil. Mr. McKee's background of experience in Brazil, where he spent six years operating an electric utility system before going to Portland in 1933, particularly qualifies him for this new position. In recent months Mr. McKee has been a special representative of the Metals Reserve Co., also an RFC subsidiary, procuring critical metals from Brazil. His services are being contributed to the government by the companies he heads in Portland.

▶ R. T. MURPHY, Murphy Electric Co., Ltd., Victoria, B. C., has been named president of the Victoria Electrical Association, succeeding E. H. Emery.

▶ FLOYD M. HARTMAN, formerly assistant district manager for the Public Service Co. of Indiana, Inc., at Kokomo, has been appointed district manager at Wabash, succeeding L. J. Evans, who has been assigned to the Kokomo division. Mr. Hartman started with the Wabash Valley Electric Co., Clinton, in 1924 as a meter reader, later being made meter shop foreman of the same company. In 1931 he was appointed meter superintendent, in 1938 local manager at Spencer and in 1940 assistant district manager in Kokomo.

▶ DR. THOMAS E. FRENCH has been made recipient of this year's Lamme medal award for meritorious achievement in engineering, President Howard L. Bevis of Ohio State University has announced. The award to Dr. French, emeritus professor of engineering drawing, goes each year to an Ohio State alumnus who has distinguished himself in engineering. He will receive the award at commencement on June 11.

▶ ROBERT R. ZISETTE has been appointed general sales manager of SKF Industries, Inc., Philadelphia. Following graduation from Yale University in 1921, Mr. Zisette started with SKF Industries. After spending one year in engineering and sales departments he became sales engineer in the Cleveland office. He remained in this position for seven years, then was promoted to district manager of the Cincinnati office. He was promoted last year to the position of assistant sales manager.

F. W. Linebaugh Assumes New Executive Duties

Frank W. Linebaugh, district manager for the Iowa Electric Light & Power Co. at Boone, has been named a vice-president of that company.

A veteran of more than 30 years' service with the company, Mr. Linebaugh got his first utility experience as manager of the Ames, Iowa, municipal plant, a position which he held for eleven years. In 1912 he went to Boone, Iowa, as manager of that property for the new owners. The property had been acquired shortly before that date by the Iowa Railway & Light Co., which later became the Iowa Electric Light & Power Co.

The advancement of Mr. Linebaugh is in recognition of his many years of outstanding service to the company. In a letter announcing the appointment, Sutherland Dows, president, said: "Your many years of service and the high quality of your performance of the duties falling on your shoulders are deeply appreciated by the board and well warrant this recognition."

Mr. Linebaugh will continue to maintain his office at Boone.

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▶ JAMES H. PURVES has been elected to the newly created position of assistant treasurer and assistant secretary of the Westinghouse Electric & Manufacturing Co. Mr. Purves has been investment manager and administrator for the company's paymasters and bank deposits since 1938. He will continue in that capacity.

▶ T. W. BOWRY, inspector in charge of sales control of electrical materials, appliances, etc., for the city of Richmond, Va., has been elected president of the International Association of Electrical Inspectors. Mr. Bowry served as chief electrical inspector for

POWER— MORE and M

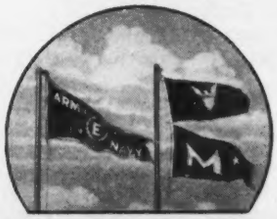
Electric power output has reached an all-time high —and is still moving upward. The increasing demands of industry are being met, as are also those for electricity for domestic use.

The credit for this almost miraculous situation belongs principally to the public utility companies, which in peace time correctly interpreted trends and prepared to meet what were certain to be unprecedented demands on their capacity.

In meeting these demands today, many of the central-stations have the help of newer types of Babcock & Wilcox Boilers, the High-Head, Radiant, Open-Pass, and Integral-Furnace. Each of these types definitely satisfies the requirements of some combination of operating conditions,as is evidenced by the fact that B&W boilers of these types alone in service have a nominal total steam-generating capacity of 42,000,000 lb. per hour.

While we take understandable pride in the performance of our boilers, we feel that to the designers, engineers and operators of the public utilities belongs the real credit for meeting the demands of the industrial and domestic power consumers in this emergency.

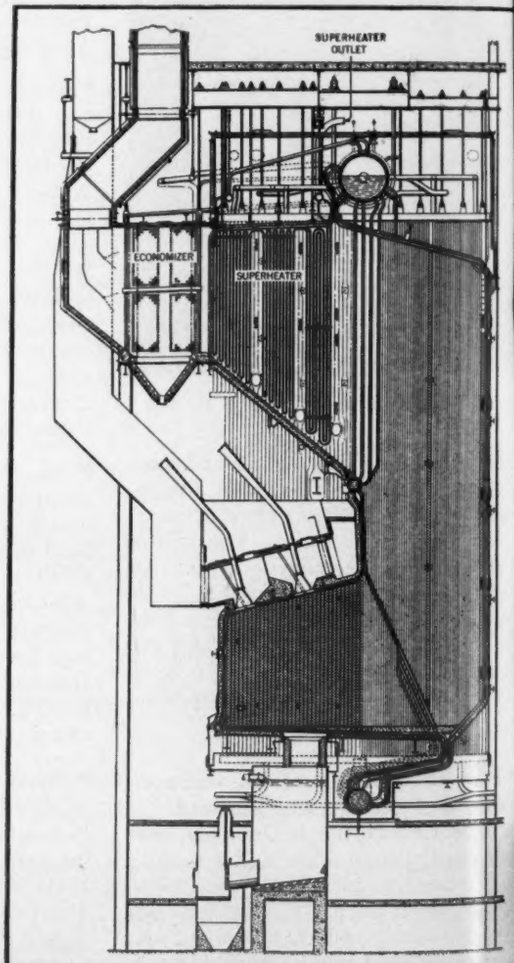
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK, N. Y.



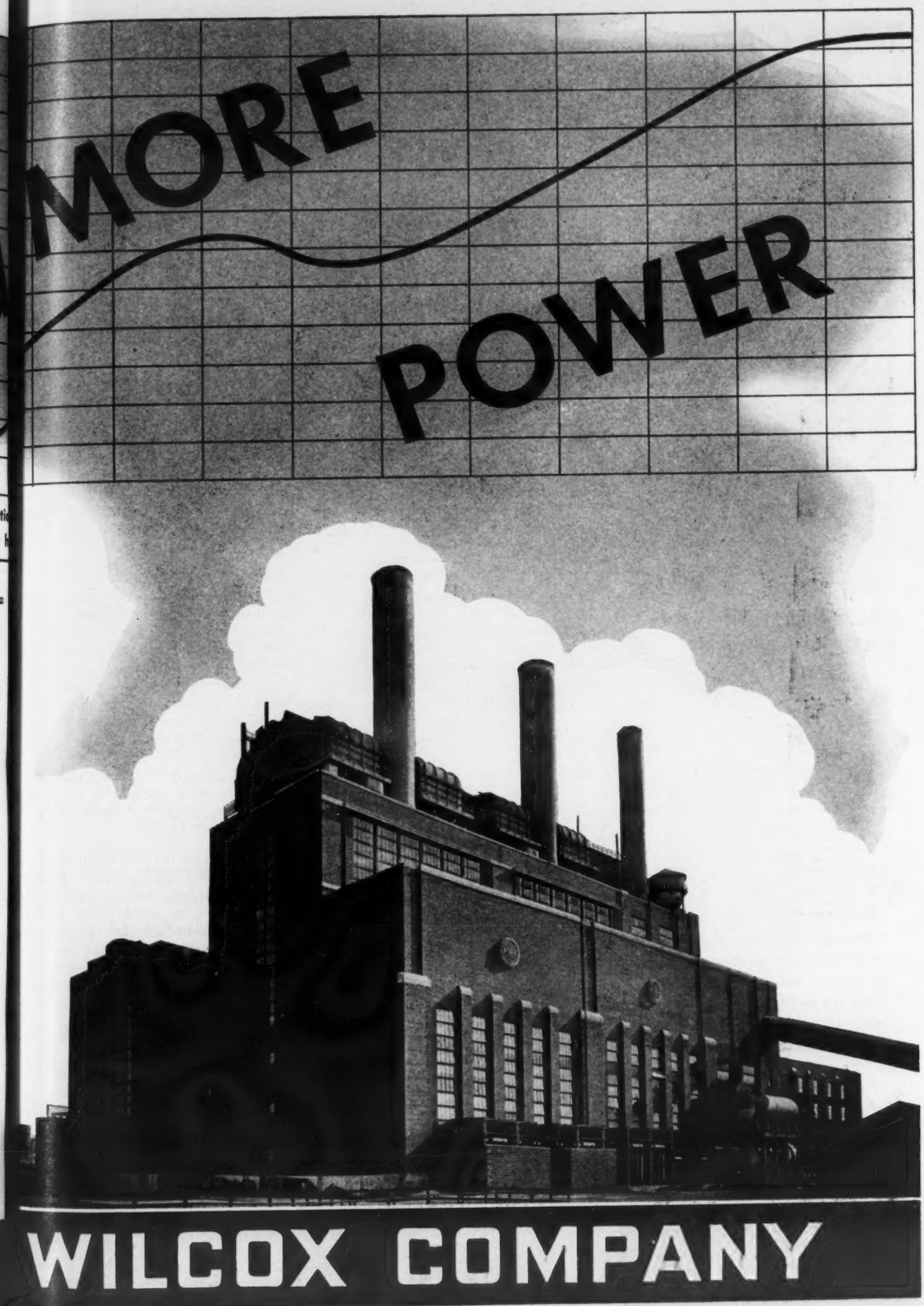
The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

G-250T

Typical B&W Radiant Boiler in Central-Stati
Service. Capacity 550,000 lb. steam per h

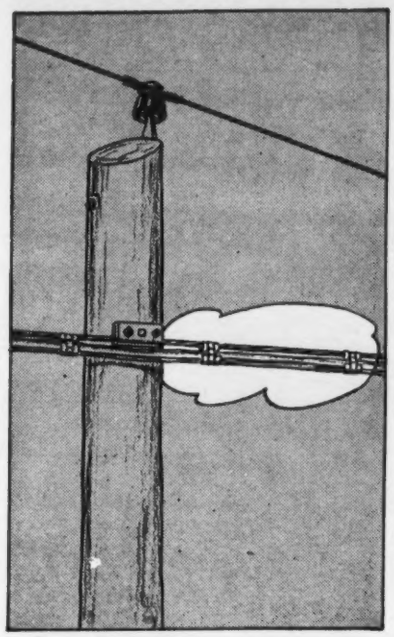


THE BABCOCK & W



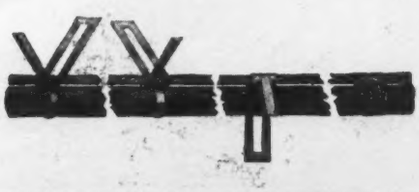
WILCOX COMPANY

Reduce Outages
Avoid Cable Wear
Reduce Maintenance



RELIABLE CABLE HANGERS

prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat.



Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

the city of Richmond from 1924 to 1940. He is a native of Richmond, Va., and obtained his early experience with the Western Union Telegraph Co., with the city of Richmond in several capacities and the C. & O. Railway Co.

•

H. S. Slocum Retires; Orr Named to Succeed Him

Harry S. Slocum, resident engineer of the Appalachian Electric Power Co., at Bluefield, W. Va., who has been closely identified with the expansion program of the company since its inception, has retired from active service. He has been succeeded by C. L. Orr, American Gas & Electric Co. engineer, who in recent years has been connected with the Ohio Power Co., at Philo, Ohio.

Mr. Slocum began his engineering career with the Niagara Falls Power Co. as a draftsman, later becoming a designing engineer at that plant and at the sister plant on the Canadian side. Subsequently he joined Viele, Blackwell & Buck, consulting engineers of New York, and was sent to California, where his firm was engaged in construction work for the Great Western Power Co. He then spent several years in Canada and was engaged on power plant construction in northern Canada and in Oswego, N. Y., in addition to acting as consulting engineer on many other projects. While associated with Viele, Blackwell & Buck, he went to Virginia and made the preliminary investigations for the construction of hydro plants on the New River, following through as resident engineer on the construction of the Byllesby and Buck hydro-electric plants. He later appraised the power plants of the Pocahontas Fuel Co. and other companies which were taken over by the Appalachian Power Co. as standby units. In 1917 Mr. Slocum went to Glen Lyn and was resident engineer on the construction of the Glen Lyn steam plant. Since then he has had charge of the construction of the hydro-electric plant near Radford, known as Claytor, and several other plants near Charleston, W. Va.

•

► GRANT B. SHIPLEY has been elected chairman of the board of directors of the Elliott Co., Jeanette, Pa. Mr. Shipley has had extensive industrial experience, having started in the shop as a mechanic, then progressing to draftsman, designer, construction engineer, chief engineer, sales engineer and manager. He organized several substantial enterprises, of which he was president and chairman. As an engineer he has been connected with power plant equipment, shipbuilding, mining and wood preserving. Mr. Shipley is a director of both the International Nickel Co., Inc., the International Nickel Co. of Canada, Ltd., and a member of the latter's executive committee, consultant to Koppers Co. and others.

► MILTON B. LENT has been appointed manager of the Naugatuck and Seymour district of the Connecticut Light & Power Co. He has been connected with the company since 1934 and before World War I was employed by it in clerical service. His headquarters will be at Naugatuck.

► FREDERICK R. LACK has been elected a vice-president of the Western Electric Co. Mr. Lack, who resigned as an officer of Western Electric last November to become director of the Army and Navy electronics procurement agency with offices in Washington, will now resume the direction of Western Electric's radio division in New York.

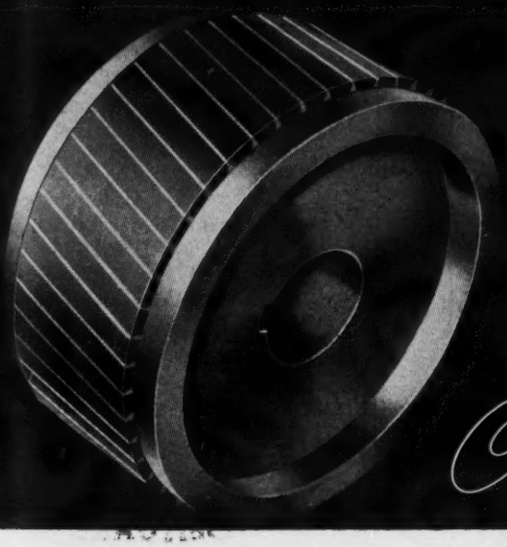
► G. W. ADRIANSON has resigned as manager of industrial relations of the Commonwealth Edison Co., a position he had held since 1937. ROY A. DINGMAN, formerly assistant manager, has been appointed acting manager. Mr. Adrianson became associated with the company in 1916 as an appliance salesman in the old contract department. He is a past-president of the Industrial Relations Association of Chicago. Mr. Dingman has been assistant manager of industrial relations since 1937. He has been a member of the department since he became associated with the company in 1928.

► H. J. NEWTON and GRAHAM HOLABIRD of National Electric Products Corp. have both received promotions. Mr. Newton has been called to Pittsburgh to become general sales manager of the company and Mr. Holabird has gone to San Francisco to become district manager in Mr. Newton's place. Mr. Holabird is a former San Franciscan, having many years ago operated the wholesale electrical firm named Holabird-Reynolds Electric Co. He has been active in the Pacific Coast Electrical Association and the former Los Angeles Electrical Development League.

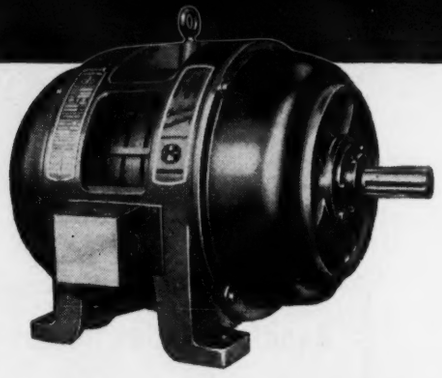
► CHARLES A. CONKLIN has been appointed manager of Westinghouse lamp division's central district, with headquarters in Pittsburgh, Pa., and ROBERT A. CORVEY has been named manager of the southeastern district, with headquarters in Atlanta, Ga. Mr. Corvey, formerly northeastern district assistant manager, succeeds Mr. Conklin at Atlanta. FRANK C. BARRINGTON,

You don't need Extra Size

With this Extra Quality



Copperspun



• No need to tell you that wartime restrictions make it impossible for you to get extra-size or extra-horsepower motors for any job that calls for specific horsepower.

But don't let that worry you for a single moment. Put Fairbanks-Morse Motors with Copperspun Rotors on the job—and you *do not need* extra horsepower or extra size.

The reason, briefly stated, is this: The winding of the F-M Copperspun Rotor is centrifugally cast, in *one piece,* of pure *copper.* No other rotor is cast of *copper.* Copper has better thermal characteristics. Copper has better electrical characteristics. For these reasons, you can run a Fairbanks-Morse Motor with Copperspun Rotor *under full load indefinitely* without danger of damage through overload.

Naturally you'd rather not buy horsepower you don't need — if you can do so safely. Now you can.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago. Branches with service stations throughout the United States and Canada.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

F M

Motors

PALNUTS KEEP SWITCHBOARD ASSEMBLIES *TIGHT!*

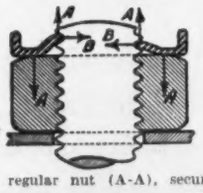
The I-T-E Circuit Breaker Company takes no chances on loosening of bolted assemblies in its switchgear. This rear view of an I-T-E 2 pole "LX" withdrawal type Circuit Breaker shows 16 places where PALNUTS are used to keep parts tight under vibration.

Specify DOUBLE-LOCKING PALNUTS *for Security!*

A switchboard cannot give continued, trouble-free operation unless all parts stay tight in service. Because of this fact, many switchgear manufacturers safeguard bolted assemblies with Double Locking PALNUTS . . . and users specify them when buying.

PALNUTS are single thread, tempered spring steel locknuts which are easily, quickly applied on top of the regular nut. Their unfailing double locking action holds tight under severe vibration and stresses. PALNUTS require but 3 bolt threads space, are light in weight, low in cost, may be removed and re-used, assure perfect conductivity on electrical connections. They are also widely used on steel towers, wood pole lines, fittings, connectors, disconnects, transformers, substation and other electrical equipment. Add PALNUTS to present equipment—specify them on new equipment. Write for Palnut Manual No. 1, giving full details.

Double-Locking Action



When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY

51 Cordier St. Irvington, N. J.

DOUBLE-LOCKING PALNUTS

at present central district manager at Pittsburgh, will retire in June after 31 years with the company. Mr. Conklin joined Westinghouse in 1922 and has been manager of the southeastern district since 1940. Mr. Corvey became associated with Westinghouse in 1923.

▶ ALFRED SEDGWICK has been appointed vice-president and comptroller of the National Battery Co., St. Paul, Minn. Mr. Sedgwick joined the National Battery Co. in 1938. Prior to that time he was comptroller of the Waypoyset Manufacturing Co., Pawtucket, R. I., for eight years. From 1920 to 1930 he was connected with Stone & Webster of Boston in various locations and capacities.

▶ BERNARD F. NEMERGUTH has been appointed service manager of the electrical induction heating and hardening equipment division of the Ohio Crankshaft Co., Cleveland. Formerly chief test engineer, Mr. Nemerguth has been with the Ohio Crankshaft Co. for more than three years.

▶ W. L. LINDGREN has been appointed production manager of Curtis Lighting, Inc., Chicago. Mr. Lindgren was formerly connected with the Modern Steel Equipment Co., Geneva, Ill., where he was plant superintendent. A native of Sweden, Mr. Lindgren came to this country in 1906 and has had long and varied experience in similar positions for the metal working and telephone industries.

OBITUARY

Robert W. Rollins

Robert W. Rollins, 79, for many years an outstanding electric utility executive in New England, died at Worcester, Mass., on May 19. He was born at Newbury, Vt., and entered the employ of the Hartford (Conn.) Electric Light Co. in 1885, later joining the staff of the Schuyler Electric Co. of that city, manufacturer of generators. Returning to the Hartford utility, Mr. Rollins served as station operating engineer until he resigned to become district engineer of the Westinghouse company at Boston. He installed the first arc lighting system at Havana, Cuba, about 1900. Again returning to Hartford, Mr. Rollins became assistant superintendent, then general superintendent and ultimately general manager of the electric light company in close association with Austin C. Dunham, then its president and a pioneer in utility development. In 1911 he was made manager of the Worcester Electric Light Company and later its president, retiring from that post in 1929. He was a past-president of the New England

Use This Check List

WHEN INSTALLING BRUSHES ON YOUR ELECTRICAL EQUIPMENT

1. See that all terminals are securely fastened to the brush holder support.
2. Remove dirt and grit from brush holders.
3. Provide 1/8" to 1/16" clearance between commutator and nearest portion of brush support in reaction and box type brush holders. Less clearance is sometimes preferable on small motors.
4. Keep angular position of all brush holders uniform with respect to the commutator.
5. Check neutral point and space the brush arms equidistant about the commutator.
6. See that toes of all brushes on each arm are parallel with commutator segment.
7. To prevent streaking of commutator, stagger brushes in positive and negative pairs.
8. Seat new brushes on commutators and rings accurately with sandpaper or a brush seating stone.
9. Adjust brush spring pressure to conform with manufacturer's recommendation.

Care exercised in the installation, fitting and adjustment of brushes increases life, improves performance and eliminates many of the possible causes of interrupted service.

NATIONAL *Carbon, Graphite and Metal-Graphite* BRUSHES

"National" brushes are doing their full share of carrying the enormous load demanded by the Nation's war effort. Essential requirements must be met first. Every effort is being made to satisfy all demands for our brushes in the shortest possible time.

Proper maintenance is paramount in keeping your electrical equipment operating at full efficiency. Many valuable and time saving suggestions as well as details of operations mentioned in the above check list are included in this series of "Modern Pyramids" bulletins. Copies are available promptly upon request.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

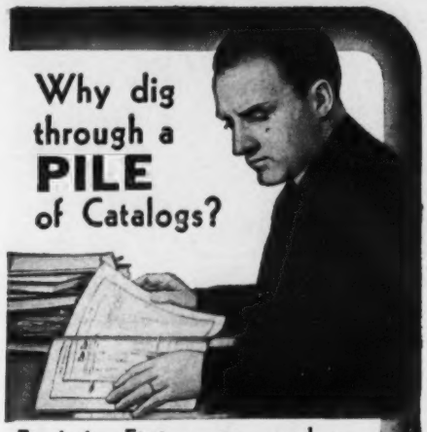
CARBON SALES DIVISION, CLEVELAND, OHIO

General Offices: 30 East 42nd St., New York, N. Y.

Branch Sales Offices: New York, Pittsburgh, Chicago, St. Louis, San Francisco

LET'S GO! U.S.A. · KEEP 'EM FLYING!

THE WORDS NATIONAL AND THE SYMBOL ARE REGISTERED TRADE-MARKS OF NATIONAL CARBON COMPANY, INC.



Why dig through a **PILE** of Catalogs?

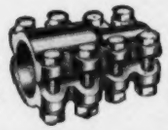
Find the Fitting you need—quickly—in the COMPLETE line

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

Universal Clamps to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

L-M Elbows, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.

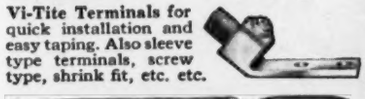
Bus Bar Clamps for installation without drilling bus. Single and multiple. Also bus supports — various types.



Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.

Jack-Knife connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

Vi-Tite Terminals for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.



Splicing Sleeves, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

Preferred by utilities, industrials, electrical manufacturers, contractors — because *they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

section of the former National Electric Light Association and a director in various banking and industrial organizations.

•

▶ JOSEPH A. ROBINSON, sales engineer for the National Carbon Co. in New York, died, of a heart attack, on May 16 in his home at Baldwin, Long Island.

▶ EDWY L. TAYLOR, a member of the Public Utilities Commission of Connecticut from 1931 until his retirement in 1941, died on May 17 in Camden, Me., of a heart ailment. He was 63 years old. Mr. Taylor was born in Albany, N. Y., and was graduated from Yale University in 1904. After several years as an instructor at Yale he became affiliated with the New York, New Haven & Hartford Railroad, remaining until 1930. He was appointed to the Public Utilities Commission in 1931 and was chairman in 1934, 1935 and 1938.

▶ M. CEDRIC DOWLING, assistant secretary of the Consumers Power Co., Jackson, Mich., in charge of plant accounting, died, of a heart attack, on April 30 at the age of 53. A graduate of Yale University, Mr. Dowling joined the company in Jackson in 1913.

▶ GEORGE ALLISON, financier and director of public utilities in Wisconsin and Maryland, died on March 30, after a long illness. He was 64 years old. He entered the firm of Clement C. Smith Co. and in 1908 became secretary of the Eastern Wisconsin Railway & Light Co. in Fond du Lac and of the Wisconsin Electric Railway in Oshkosh. Later he was comptroller of the Lee County Lighting Co., Dixon, Ill.; the Citizens Gas Co., Kankakee, Ill., and the Columbia Construction Co. He served at times as secretary and treasurer of the Heil Co. and the Wisconsin Electrical Association. Mr. Allison retired in 1928 and made his home in St. Petersburg, Fla., later returning to Milwaukee.

▶ ERNEST W. MULLER, electrical engineer and a member of the firm of Kaiser, Muller & Davies, New York, died on April 8, in his sixty-ninth year. Mr. Muller was a member of the American Institute of Electrical Engineers and of the New York Electrical Society.

▶ KEITH B. LYDIARD, an account executive with the Alan B. Sanger Advertising Agency and president in 1940-41 of the Industrial Advertising Association of New York, died on May 8 in the Norwegian Hospital, Brooklyn, after a short illness. He was 35 years old. Following graduation from the University of Maine in 1929 he joined the Babcock & Wilcox Co. After a year at the company's plant at Barberton, Ohio, he entered its advertising department in New York, but severed his connection with the company in 1937 to enter the advertising field.

▶ ALBERT H. KREUL, assistant superintendent of the electrical maintenance and repair department of the Portland General Electric Co., died on May 5 in a Portland hospital, after a long illness. He was 58 years of age. Born in Wisconsin, Mr. Kreul was graduated in electrical engineering from Iowa State College. He had been connected with the Portland General Electric Co. for 33 years.

▶ CHARLES C. ABBOTT, 72, retired managing engineer of the specialty department of the Pittsfield Works, General Electric Co., died recently at Pittsfield, Mass. He was widely known for his contributions to industrial electric heating development and was the inventor of the "Calrod" unit, for which he received the Charles A. Coffin Award in 1932. He joined the staff of the former Stanley company at Pittsfield in 1900 and was retired from G.E. service in 1940.

▶ LEWIS F. BYINGTON, attorney and president of the San Francisco Public Utilities Commission, died, of pneumonia, on May 7 in Stanford Hospital, San Francisco, at the age of 75. Mr. Byington was elected three times district attorney of San Francisco, serving through 1906. The late Gov. James Rolph, Jr., appointed him to the Board of Supervisors to fill a vacancy and he was pressed into service as president of the Civil Service Commission in 1931. He was educated at Santa Clara University and the Hustings College of Law.

▶ GEORGE M. ANDERSON, manager of the south division of the Shawinigan Water & Power Co., died on April 7 in the Montreal General Hospital, after a short illness. He was 69 years of age. Mr. Anderson first became associated with the Shawinigan utility in 1903. Later he joined the staff of the Sorel Light & Power Co., returning to Shawinigan in 1910, when he engaged in the construction of steel transmission lines running from Shawinigan Falls to Montreal. After a few years he was made superintendent of the North Shore Power Co. at Three Rivers. In 1923 he resigned that position to become general manager of the Great Northern Power Co. The following year he again returned to the Shawinigan organization as manager of the St. Francis Water Power Co. and several years later became manager of another Shawinigan subsidiary, the Beauharnois Electric Co., with headquarters at Valleyfield.

TO HIT 'EM H-A-R-D-E-R

THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* attention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

★ ★ ★

You've done your bit Now do your best!

This space is a contribution to victory today and sound business tomorrow by ELECTRICAL WORLD

MANUFACTURING-MARKETS

Line Material Net Totals $566,256

Net income of the Line Material Co. for the year 1942, after taxes, amounted to $566,256, equal to $1.32 each on 427,232 shares, against 1941 net of $776,995, or $1.82 a share. Net sales totaled $11,757,652, compared with $14,411,397 in 1941.

McGraw Electric Co. reports for the twelve months ended March 31, net profit of $854,061 after depreciation and a provision of $1,153,000 for federal income and excess profits taxes. This net is equal to $1.80 a share on 472,600 shares of capital stock, and compares with a revised net profit of $1,522,333 or $3.22 a share for the twelve months ended March 31, 1942. Net sales for the twelve months totaled $8,081,714 against $11,117,337 in the similar period a year earlier.

Among the companies reporting net earnings for the first quarter of 1943 are the following:

WORTHINGTON PUMP & MACHINERY—Including domestic subsidiaries, net profit after $4,463,399 federal income and excess profits taxes and an addition of $250,000 to reserve for post-war rehabilitation was $870,141, equal to $2.63 a common share. Net profit for period last year, after $2,014,849 tax provision, was $877,947, or $2.67 a share.

NASH-KELVINATOR—Net profit, $590,204 after all charges, including provision for income tax, comparing with $672,360 for the corresponding period of last year.

CONTINENTAL-DIAMOND FIBRE—Including wholly owned domestic subsidiaries, net income, after $642,000 provision for federal taxes on income, less $55,000 post-war refund, and $25,000 provision for contingencies was $165,669, compared with $106,912 net for similar period last year when $376,000 was deducted for taxes and $25,000 was provided for contingencies.

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Additional Plants Get Army-Navy "E" Award

General Cable Corp. plants at Perth Amboy, N. J., and Rome, N. Y., have received white-starred flag awards representing renewal of the previously awarded Army-Navy E for war production.

The Barberton works of the Babcock & Wilcox Co. has just been awarded the second renewal of the "E" award. This same plant received a renewal award of the Maritime "M" by the Maritime Commission.

Among other recent recipients of the "E" award are: American Brass Co., Kenosha Brass Co., Kenosha, Wis.; Borg-Warner Corp., Rockford Drilling Machine Divisions, Plants Nos. 1, 2 and 3, Rockford, Ill.

•

G.E. Holds Wartime Lighting Course

More than 150 lighting counselors attended the spring Wartime Lighting Course held at G.E. Institute, Nela Park, Cleveland, May 10 to May 14. The first two days of the course were devoted to lighting fundamentals. The next two days were devoted to lighting applications; the last day was given over to infra-red and germicidal lamp applications. Nearly fifty illustrated talks on a wide range of lighting subjects were delivered by leading Nela Park engineers. Topics covered by speakers included: Government limitations on lighting; priorities; lighting to minimize sabotage; dimouts; brownouts; blackouts; use of infra-red in war plants, on farms, and in homes.

A particularly interesting talk was given by Harold H. Green, G. E.'s supervisor of wartime lighting service. His topic was "Sight for Victory," in which he trained his sights on post-war planning and the vital role which the lighting man can play in the reconstruction period following the war.

•

Post-War Applications of Plastics Discussed

Post-war applications of wartime research in the laminated plastics field will provide many innovations for industrial and consumer uses, D. J. O'Conor, president of the Formica Insulation Co., Cincinnati, stated recently, in summarizing developments in the company's engineering department.

Wartime restrictions, he said, prevent "description of many details," but "typical of the refinements and developments is the ability to produce a thoroughly satisfactory translucent sheet of laminated plastic material to be offered to the post-war market." A wide variety of developments in the decorative field recorded as the result of wartime applications will likewise be available for use in such establishments as hotels, public buildings, theatres, stores, restaurants and offices.

TWO STARS FOR HUBBARD—Hubbard & Co., Pittsburgh, was honored recently by the bestowal of two stars for its Army-Navy "E" pennant in recognition of continued excellence in production of war materials. Joseph V. Smith, executive vice-president, is shown acting as master of ceremonies at the award, while John W. Hubbard, far right, accepted the pennant for the company. Joseph Sparbana, president of Hubbard Local 211, accepted the Army-Navy "E" lapel pins in behalf of the employees

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Burned down Friday—operating Monday

Wesco Rushed 11 Electrical Products; Saved 4 Weeks' Stoppage, Cut 49 Paper Operations

The four alarms brought all the fire apparatus but by Friday night the war plant making vital aluminum aircraft parts was a smoking ruin. The manager said—"We must be at work Monday morning" and phoned the local Wesco House. He specified immediate need of 11 electrical items including safety switches, motors and control, wire and cable.

During Saturday and Sunday Wesco delivered the complete order from stock as needed. Monday morning the workers stood under the open sky but the plant was humming. Only an Electrical Wholesaler could have done that job. For without Wesco this factory would have run up heavy phone bills in frantic appeals to 4 manufacturers, waited 30 days for complete delivery of products and piled up 60 costly clerical operations which Wesco preparedness reduced to 11.

This is one example from scores in which Wesco's 80 Branches are hastening Victory by helping speed war production. After the war these services and stocks will be again at the command of business and industry everywhere.

WESCO SPEEDS WAR PRODUCTION

* While building a large steel mill several electrical items from 6 different manufacturers were suddenly required. Delivery promises ranged from 60 days to 9 months. Wesco delivered all the items in 3 days and saved 74 paper transactions.
* Overnight delivery of hundreds of electrical products was required for a Marine air base. By pooling the stocks of 5 Wesco Houses all the items were on hand the next morning.

WESCO SERVES BUSINESS

* By assembling all parts of an order in one shipment.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
* By extending credit to help finance jobs.

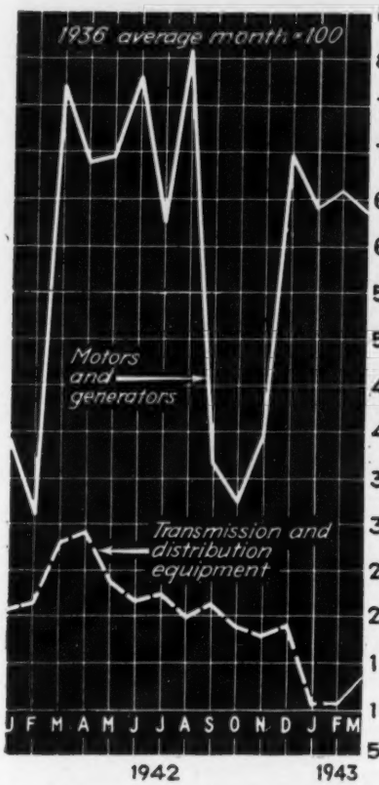
Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

T. & D. Orders Rise; Generators Drop

New orders received for motors and generators during the month of March turned downward, according to the index compiled by the National Electrical Manufacturers Association. The index dropped to 639 from 661 for the month



NEMA INDEX, value of orders received

of February, a decrease of 3 percent, and a decrease of 17 percent from the index of March, 1942, which stood at 769.

The index covering new orders for transmission and distribution equipment advanced from 105 (revised) in February to 138 in March, an increase of 31 percent. It dropped 51 percent under the figure recorded for March, 1942—280.

•

G.E. Issues Booklets on Wartime Homemaking

What is in effect a practical course in improved methods of wartime home making has been launched in a series of nine booklets announced by the General Electric Consumers Institute at Bridgeport, Conn. Five of the nine booklets just announced concern food. The other four cover the following subjects: house cleaning, washing of work clothes, fuel conservation and care of appliances.

Field Reports on Business

Electrical industrial equipment orders off as war industry expansion continues to drop. Engineering construction down 60 percent from 1942. Retail buying wave continues, but inventories are decreasing. Motor and control equipment sales slowing down, but some big orders are being placed. Utility orders confined to replacements.

NEW ENGLAND

Several aspects of the electrical market in New England stand out prominently. The steady slowing down in small motor and control equipment sales is being punctuated not infrequently by orders of good size ranging up to 100 motors per lot aggregating 100 hp. or more; large motor sales are decidedly dull, though some motor pumping units have been sold recently and the Army has installed special pumping units for fire protection within its areas. Buying, on the whole, is more deliberate; deliveries are still limited to six weeks or more for some classes of motors; machine tool builders continue to dominate the market for motors and control and in some special lines of machine tools builders are expecting an early resumption of foreign orders.

During the past week friction tape orders were awarded to Massachusetts and Connecticut manufacturers; an order for 2,500 insulators by the General Ceramics Corp. will be handled by its Keasburg, N. H., plant, and James Millen Mfg. Co., Malden, Mass., was allotted an order for furnishing the Navy with large electric sockets. Tenders for vacuum tubes, magnet wire, wiring supplies and small knife switches were submitted last week by New England producers.

Prospects for more buying of wiring supplies appear with the awarding of a $500,000 contract to Bianchi & Co., Framingham, Mass., for the construction of buildings and installation of services under Army supervision, and the approval of a contract for constructing 100 more family units for war workers at Quonsett Point, R. I. An addition to the Bedford (Mass.) Veterans' Hospital to be started soon will cost about $250,000, and groups of temporary frame buildings estimated to cost less than $50,000 each will be built in Maine and eastern Massachusetts. The Navy has awarded a contract to E. Turgeon, Providence, R. I., at $135,313 for the construction of an additional building for training purposes.

CHICAGO

While building of all types in Illinois for April increased in both number and value of projects over last month, all three classifications—residential, nonresidential and additions—showed decreases in number and value compared with April a year ago. Out of 181 reporting Illinois cities 81 reported higher permit valuation in April than March, but only 29 had increases over last year. Greatest activity was in non-residential construction with 516 permits for buildings totaling $911,655, an 84.9 percent increase in number and 274.8 percent increase in value over March.

Electrical contractors with motor repair shops and used equipment dealers continue to report business strong and active. Manufacturers orders for electrical industrial equipment are off somewhat as war industry expansion continues to drop. Compared with last month, however, there has been a slight increase in some lines. Utility orders continue to be few and limited to repair parts and replacements. A temporary increase in utility and industrial orders next month may follow current flood damage in the Mississippi Valley.

The regional WMC in mid-May relaxed the job-freeze to permit essential workers to transfer to higher paying jobs until July 15. The move appears to be aimed at speeding the transfer of skilled men to Chicago's huge west side plane plants now going into production.

Electrical output of the Commonwealth Edison group of companies serving the Chicago area for the second week in May increased 13.6 percent over a year ago.

Chicago department store sales in the week ended May 15 increased 7 percent over the same week a year ago. There was an identical increase for the previous week.

NEW YORK

Resumption of the retail buying wave in the country, together with a corresponding decrease in retail inventories, is noted in Federal Reserve Board and Federal Reserve Bank reports. For the week ended May 15, department store sales nationally were up 16 percent over the same week a year ago while, for the four-week period ended May 15, the rise was 13 percent. Department stores in the New York area had a gain of 10 percent but the increased retail buying resulted in a decrease of inventories which amounted to 32 percent below that of a year ago. Falling off in retail sales is expected to occur soon due to depleted stocks and critical shortages in many lines of consumer goods.

Civil engineering construction for the week totaled $63,929,000—30 percent lower than the preceding week, and 71 percent below the total for the corresponding week in 1942, according to *Engineering News-Record*. The current week's construction brings 1943 volume to $1,445,294,000, an average of $72,265,000 for each of the 20 weeks in the year. This volume is 60 percent below the $3,773,129,000 reported for the same period last year.

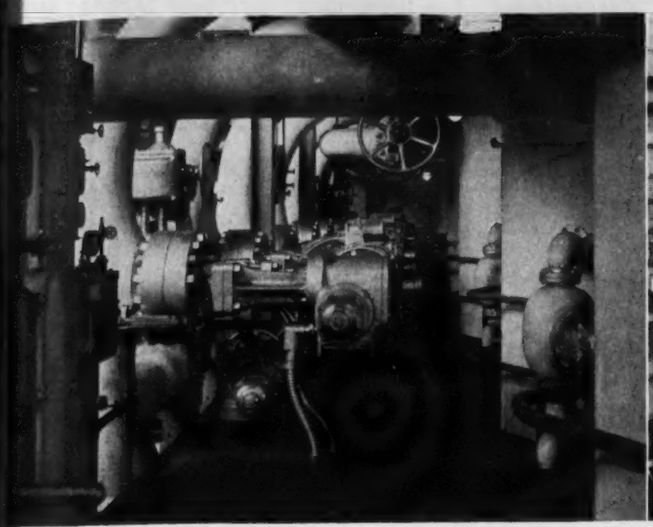
PACIFIC COAST

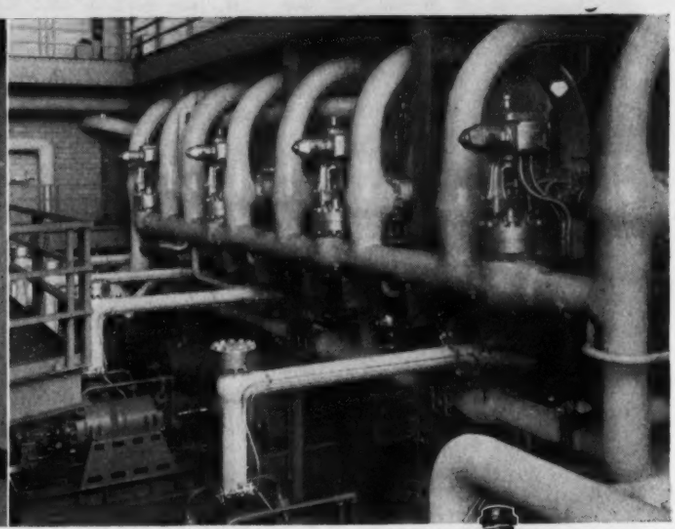
Wholesalers and manufacturers find that large orders and proposals in sizable items are gradually giving way to shorter lists in smaller lots with occasional single items in exceptionally large quantities such as last week's 1,000,000 flashlight order for the Navy and $45,000 in terminal tubes for a bay area shipyard. Coast stocks of standard roughing-in and wiring items are holding up well, being aided materially by such permissible non-critical substitutes as plastic cords and loom and the increasing substitution of thin-wall conduit and fittings.

Recent orders for heavy machinery include eight 100-kw. generator outfits with panels and controls, two G.E. oil circuit breakers costing $27,000 for installation by Pacific Gas & Electric Co. at its Newark station, three 1,500-hp. motors for pumping to cost $16,000, 200 assorted motors sizes ½ to 2 hp., and 15 5-hp. speed reducers, value $25,000, for a shipyard.

Considerable headway has been made by WPB in western states in setting up and pooling small plants for war work, one result being reflected in a steady flow of orders for insulating and other maintenance material.

Centralized Valve Control





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through the application of

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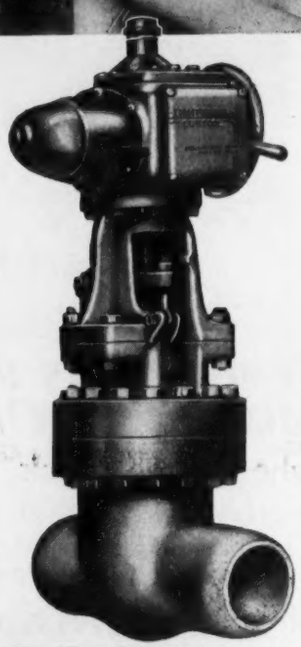

Limitorque Controls at Burlington provide centralized push button control of valves *ranging from those on 12"—1250 pound steam lines to those on 3"—300 pound oil lines, and on water from 48" gate valves to 9' wide x 10' high sluice gates . . .* in normal, every day operation of the station as well as for emergency and safety purposes. This keeps the operation of important valves under the watchful control of responsible key men.

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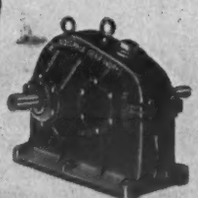

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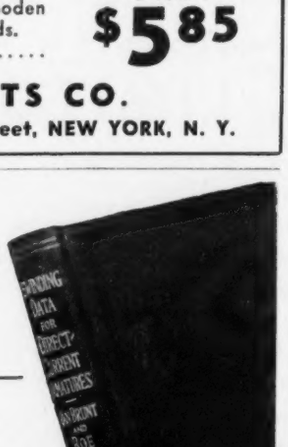

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Westinghouse Announces Post-War Policy

A post-war policy "with both feet on the ground" is outlined by T. J. Newcomb, sales manager of the Westinghouse Electric Appliance Division, Mansfield, Ohio, in an open letter to 32,000 electrical dealers throughout the nation.

"Our post-war planning in the interests of consumers and dealers covers two stages," Mr. Newcomb reported. "First, when the war is over we plan to get into production fast on essentially those products you sold just before the war. We shall improve them, but won't experiment with radical changes."

The second phase, the Westinghouse executive explained, is "bring along the revolutionary new developments as quickly as they can be proved."

•

Philco Issues Production for Victory Report

While production goes on apace, the Philco research laboratories are at work on vital and secret electronic development projects to aid the war effort, Philco reports to its 20,000 dealers in a summary of its war activities, entitled "One Year of Production for Victory." The report tells in detail how the complete facilities of Philco laboratories, production lines, machinery, engineering and factory personnel and the company's far-flung service organization were turned over 100 percent to war production.

•

Roebling Organizes New Aircord Division

Announcement has been made by John A. Roebling's Sons Co., Trenton, N. J., of the establishment of a separate department to serve the aircraft industry, to be known as the aircord division. The move was made necessary, Roebling states, by the growing needs of the field and the increasing part that the company is playing in it.

The division will have as manager Forest S. Burtch, previously assistant chief engineer, wire rope engineering department.

•

Moves "Frisco" Office

Aluminum Co. of America has announced the removal of its San Francisco office to a new location—Room 615, Russ Building.

LETTERS TO THE EDITOR

Bi-Monthly Meter Reading Period

To the Editor of ELECTRICAL WORLD:

I was interested in your issue of April 17 to read some reactions to bi-monthly billing and the fears expressed by those who have not taken the plunge.

Bi-monthly billing may be new to operators in the United States, but in Canada it has been in effect for many years; the Montreal Light, Heat & Power Consolidated, with nearly 500,000 gas and electric customers, has had bi-monthly billing, excepting for large commercial customers and power customers, for many years, and Montreal is a city in which the population is cosmopolitan and, furthermore, is plagued with a single moving date, viz., May 1, when normally 60,000 people change residence. Bi-monthly billing has been quite successful in this case.

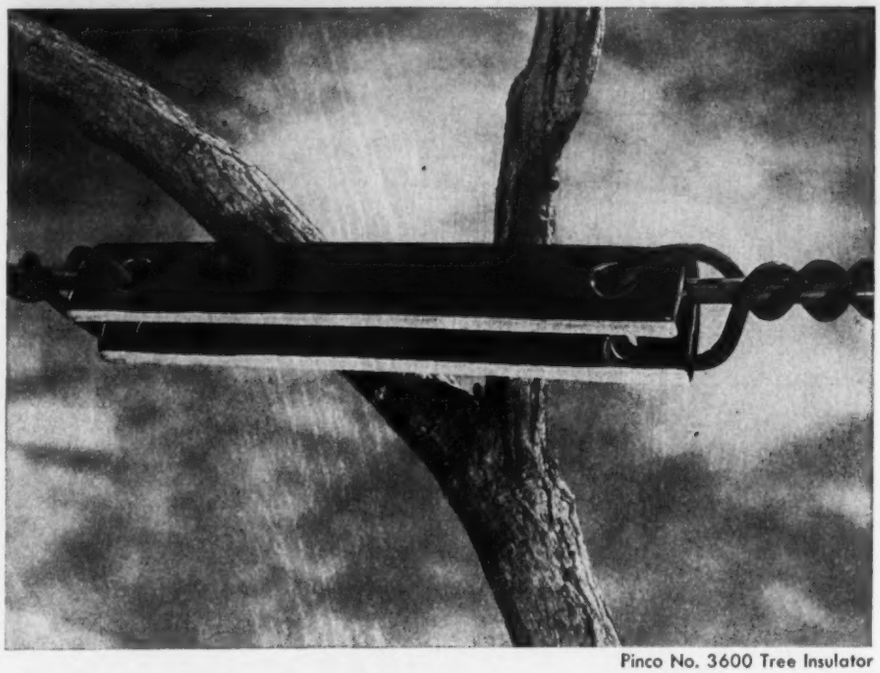
We changed our smaller communities to bi-monthly billing some time ago and now are changing all our other customers; there is nothing against it; we have found no trouble with collection of accounts; we have had no kicks from our customers, and we contemplate going to billing every three months some day, when the time seems opportune.

We do not attempt to estimate, or require the customer to read his meter, and render an interim bill; we see absolutely no reason for doing this.

For many years we have been reading meters to the lower 10; this makes the billing much easier because it requires one-tenth the number of bill calculating charts that are necessary in billing to the nearest kilowatt-hour. When a customer leaves, we, of course, bill to the last kilowatt-hour. This might have been expected to cause trouble, because there is a possible fluctuation of 10 kw.-hr. for equal periods, but when the customer understands that the breaks are with him always, that we read to the lower 10 and that he can't possibly pay too much, the few kicks that we had were easily ironed out. This is a real time saver and a practice that we borrowed from the Hydro-Electric Power Commission of Toronto, which is using it for commercial billings only.

In England practically all billing is quarterly, but conditions are different there, because people don't move very often, unless it is from one locality to another.

We think that bi-monthly billing is



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FOR TREE, WIRE AND SERVICE

PINCO *Tree Insulator*

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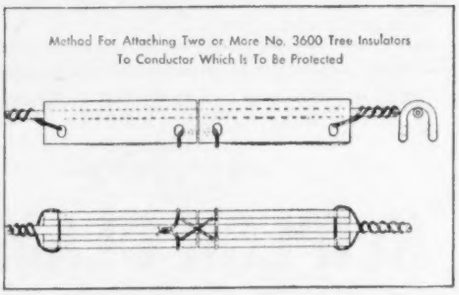
Pinco Standard Insulators are catalogued in the Electrical Buyer's Reference.



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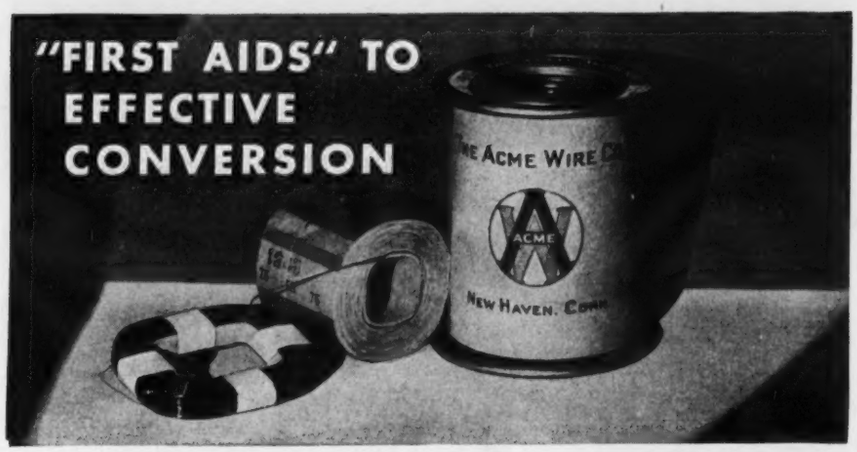

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•

Toward Better Employee Understanding

To the Editor of ELECTRICAL WORLD:

In the April 3 issue of ELECTRICAL WORLD the subject "What Do the Employees Actually Think?" is timely and very clearly states the problem and suggests a general solution. However, the stated solution is in reality the problem, which has, as far as we are able to learn, been only feebly attacked. It occurs to us that it is necessary to undertake the preparation of a comprehensive presentation of information covering the essential background of our business and present it in such a way that employees can obtain an appreciation of the various forces affecting our industry. This, of course, is a gigantic task and with the press of immediate details of business it has not been done.

Our company is vitally interested in such service and has developed one along lines which we feel will be helpful not only to our own group but also valuable to other groups as well. Our over-all plan of information is divided into three major sections. So far the first section has been completed and presented to all of our employees.

The second deals with those elements which have their effect upon our business, such as anti-business organizations; governmental agencies, the Federal Power Commission, Securities and Exchange Commission, etc; governmental projects, REA, TVA, GRDA, Bonneville, Grand Coulee, Santee-Cooper, Dennison Dam, Loup River Development, etc. An intelligent discussion and proper appreciation of the effect of these projects can be had only with some background of history—government and business.

The third section deals more particularly with details of our own company, its organization, operation and departmental functions and will include such items as finance, rates, valuation, facilities for service, advertising, etc. This section is similar in form to those made up by other companies.

The first two sections are general enough that they could be used by any company if a few minor changes in detail were made. It is thought that these might be revised and put into printed form a little later. We have also arranged to supply supplemental material, reprints, etc., which will be used in our discussion groups, such as

Murdering Progress in Its Cradle," by James Truslow Adams; "Your Stake in Capitalism," by Eric Johnson; "After the War—What?" by Frederick J. Crawford, and "What is Profit?" by Frederick I. Kent.

The way we are handling this is as follows: We have seven groups, consisting of between eight and twenty-two members, with the department heads acting as discussion leaders. We are taking from one to two chapters for each discussion period of two hours on company time each two weeks.

Before each assignment is presented to the employee group a meeting of the discussion leaders is held and the material to be discussed in the employee meetings is covered in detail together with such additional information as is required to give a background to our discussion leaders.

In the employee discussion groups the material is handed out at the beginning of the meeting and various employees are called on to read a portion until finished. Some discussion results during the meeting; however, provision is made for a fifteen to twenty-minute discussion period on the previous material at the beginning of the session. Discussion is particularly encouraged during the question and answer portion of each chapter. (At the end of each chapter are placed from fifteen to fifty questions together with the answers obtained from the preceding text.)

Our meetings were started the first of October, 1942, and have met, by and large, with favorable acceptance by our employees. This has been particularly true among the older employees.

VICTOR E. HULETT,
Commercial Manager
Oklahoma Power & Water Co.,
Sand Springs.

•

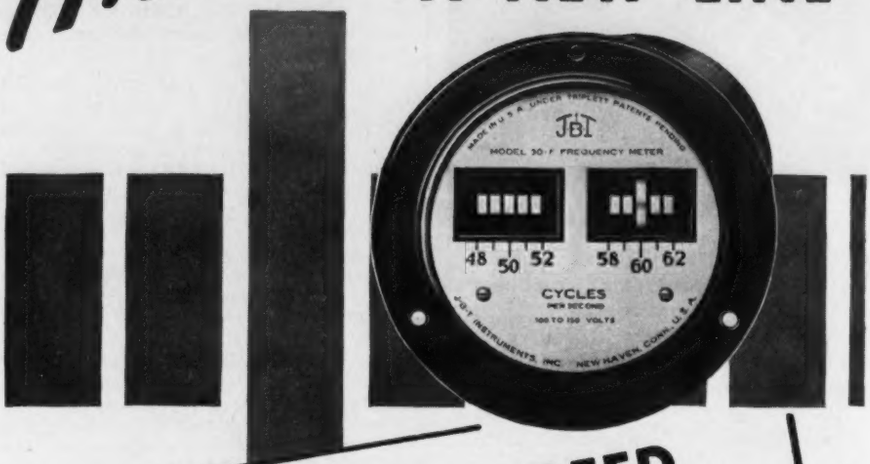
Cold-Cathode Correction

To the Editor of ELECTRICAL WORLD:

Several people have called to tell us there is a minor error in Fig. 1 of the article "What's Different About Cold-Cathode?" (ELECTRICAL WORLD, May 1, 1943, page 38), in that the tube diameter for hot-cathode is shown as one millimeter instead of one inch. They have also questioned the statement in the editorial comment shown beneath the title. This statement over-simplifies things a bit in suggesting that all the differences in electrodes can be offset through the use of greater length. Actually, it is more complicated than that.

A. C. BARR,
General Electric Company,
Cleveland, Ohio.

Announcing A NEW LINE



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Sales Opportunities

NORTH CAROLINA — Duke Power Co., Charlotte, is said to be planning extensions and improvements in distribution system and other operating facilities, in connection with recent acquisition of local properties of Durham Public Service Co. Application has been made for a 30-yr. franchise for light, power and transportation service.

MICHIGAN — Die-Typing Corp., General Motors Bldg., Detroit, manufacturer of mechanical die products, plans expansion in plant for production for government, including new building, with machinery and electrical equipment. Cost about $400,000, with financing by Defense Plant Corp. Company recently has approved plans for new steam power house at plant, reported to cost over $60,000, work to begin at once. H. E. Beyster Corp., General Motors Bldg., is architect and engineer for last noted work.

OKLAHOMA—War Department, Washington, D. C., has approved plans for new military base consisting of shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also barracks, administration building, mess halls and utility structures. A power substation is planned, with electrical distribution system for light and power service. Complete project estimated to cost in excess of $5,000,000, to be supervised by U. S. District Engineer Office, Tulsa. Austin Co., Oklahoma City, and 16112 Euclid Ave., Cleveland, Ohio, is architect and engineer.

KENTUCKY—Board of Trustees, University of Kentucky, Lexington, has authorized plans for new one-story coal distillation pilot plant laboratory, with complete mechanical and electrical equipment and facilities. Estimates of cost are being made. Proposed to begin work soon.

MICHIGAN—General Motors Corp., General Motors Bldg., Detroit, will carry out expansion in certain plants for production for government, including new buildings with machinery and electrical equipment. Entire project will cost about $1,125,000 and will be financed by Defense Plant Corp.

MINNESOTA — Veterans' Administration, Construction Division, Washington, D. C., will install interior and exterior electrical services for new buildings, including underground conduits, light and power wiring, fixtures, electric elevators, feeder lines, controls and other facilities. Complete project will cost about $723,000. Contract for building erection has been let to Hagstrom Construction Co., 490 North Snelling Ave., St. Paul.

NEBRASKA—War Department, Washington, D. C., has authorized expansion in air force base, including hangars, shops, warehouses and other structures, with installation of electrical and mechanical equipment. Extensions are planned in power substation facilities and distribution system for light and power utilities. Fund of about $2,000,000 has been approved for project, to be supervised by U. S. District Engineer Office, Omaha.

WASHINGTON — Seattle Department of Lighting, Seattle, plans new emergency outdoor-type power substation, including extensions in transmission line for power supply. Also will make additions to distribution system in area. A permit has been issued and work is scheduled to proceed at once.

MICHIGAN — Extruded Metals Defense Corp., Belding, plans expansion in plant for production for government, including new buildings with installation of machinery and electrical equipment. Cost about $1,000,000, with financing by Defense Plant Corp. Work to be carried out soon.

ARKANSAS—Civil Aeronautics Administration, Washington, D. C., and Fort Worth, Tex., has rejected bids recently received for installation of lighting system and electrical utilities, and other work at an airport and will ask new bids at early date.

MARYLAND—Bureau of Yards and Docks, Navy Department, Washington, D. C., has authorized six new double-barrel hangars at a naval air station to cost $5,460,000, with electrical and mechanical equipment. Contract for building erection has been let to Corbetta Construction Co., 220 East 42nd St., New York, N. Y., and is scheduled to begin at once.

KENTUCKY—Reynolds Metals Co., 311 West Broadway, Louisville, manufacturer of aluminum and other light metals, plans expansion in plant for production for government, including new building and installation of machinery and electrical equipment. Entire project will cost about $300,000, with financing by Defense Plant Corp.

MISSISSIPPI—U. S. Engineer Office, Mobile, Ala., will award contract soon for new hospital group, comprising several buildings, with exterior and interior electrical installation, including underground conduits, light and power wiring, fixtures, air-conditioning system and other facilities. Cost estimated about $500,000.

LOUISIANA—Sewage and Water Board, New Orleans, plans installation of motor-driven pumping machinery, with controls and other electrical facilities, in connection with extensions in water system in Michaud district. Entire project will cost about $354,800. Financing is being arranged through federal aid and application for a priority rating will be made.

OKLAHOMA—Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., Santa Monica, Calif., has contracted with government for construction and operation of new airplane plant, comprising large group of one and multi-story buildings with machinery and electrical equipment for heavy output. Also will build main power substation and several auxiliary transformer and control stations at different points, with underground and overhead lines. Entire project will cost about $7,000,000, and will be financed by Defense Plant Corp. Work is scheduled to begin soon.

MASSACHUSETTS — War Department, Washington, D. C., has authorized new army general hospital, comprising large group of one and multi-story buildings. Work will include power house for electrical service and central-heating installation, underground conduits and overhead lines, light and power wiring, fixtures. Also complete air-conditioning plant and system, and ice-manufacturing and refrigerating plant. Entire project is estimated to cost approximately $4,000,000, and will be supervised by U. S. District Engineer Office, Boston.

OHIO—Goodyear Aircraft Corp., Akron, will carry out extensions in plant for production for government, including new building with machinery and electrical equipment. Cost about $300,000, with financing by Defense Plant Corp. Company is a subsidiary of Goodyear Tire & Rubber Co., same place.

Why does this man get
61% MORE LIGHT?

Light from floors is the answer. Light-colored floors made with Atlas *White* portland cement instead of standard gray portland cement or still darker materials increase illumination on vertical work surfaces and undersurfaces. With better illumination, workers see better, spoilage decreases and production increases.

When light strikes a dark floor, most of it is absorbed. It is wasted. When light strikes a light-colored concrete floor made with white cement, much of it is reflected. The light is salvaged. It is used over and over again. Tests by General Electric in the Consolidated Aircraft plant at Fort Worth show that the white-cement floor compared with the gray-cement floor in the same plant—

- ***reduces shadows and dark areas;***
- ***increases illumination on vertical work surfaces by 20%;***
- ***increases illumination on underside work surfaces by 61%.***

Light-colored concrete floors made with Atlas *White* portland cement help bring the production-speeding advantages of better light. For the complete story, write today for your copy of the new 24-page book, "Light from Floors." Universal Atlas Cement Company (United States Steel Corporation subsidiary), Chrysler Building, New York City.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

EW-F-18

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WHITE CEMENT
For Light-Reflecting Floors

Recent Rate News

UTAH POWER & LIGHT CO. rate reduction was sought by the state of Utah in a brief filed with the courts recently at Salt Lake City. The reduction would amount to approximately $1,500,000 annually. Attorneys for the state claimed that a 36-day hearing before the Public Utilities Commission last fall had shown that such a reduction could be made without injury to the company's financial status. Utah Power & Light filed a counter brief which declared rates to be 27 percent below the national average, maintaining that no further reduction is justified at this time because of rising labor costs. Proposed reductions would include residential and commercial rates and government and municipal rates, the Department of Public Utilities said.

SOUTH CAROLINA ELECTRIC & GAS CO. electric rate reduction, which will save customers approximately $190,000, has been approved by the state Public Service Commission. The announcement was made by Rufus M. Newton, chairman of the commission. Mr. Newton said that the reduction is the result of many months of investigation and studies made by the electrical utilities division of the commission into the physical properties, financial structures and operations of the company, terminating recently into a series of friendly conferences between the officers of the company and the staff of the division which resulted in the reduction. This new schedule of rates will affect practically every category of customer served by the company, from residential users to consumers of large power. The effective date of the new schedules is June 1.

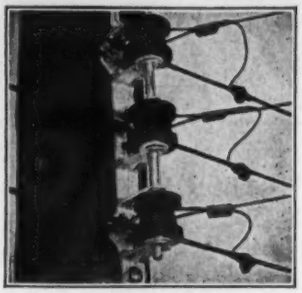
WISCONSIN PUBLIC SERVICE CORP. temporary rate reduction for rural customers out of Green Bay, authorized by the state Public Service Commission in 1941, has been extended for a year. The order means a saving of approximately $47,000 annually to rural customers of that utility.

ATHOL (MASS.) GAS & ELECTRIC CO. has established a new rate schedule effective June 1, with an estimated saving of $10,000 per year to domestic and commercial customers. The former will benefit by about $7,100 per year if on the company's A rate. Optional rate A-2 for residences is being maintained for the use of the small number of customers consuming electric service totaling under $1 per month, the minimum charge under the A rate, as well as for those using under 14 kw.-hr. per month. Manager E. F. Leach states that this is the third reduction in electric rates in three years and brings the annual saving to about $45,000 for the above classes of customers.

•

Recent Legislation

FLORIDA—State regulation of privately owned electric power and gas companies and their rates and services has been proposed in the Legislature. The bill would give the State Railroad Commission complete jurisdiction over private utility companies and require that "all rates and rules and regulations of public utility companies shall be fair, just and reasonable, and their services shall be adequate and efficient." A vigorous protest has been entered against inclusion of Miami in the bill, which would take away the city's regulatory powers on public utilities. The city commission authorized City Attorney J. W.



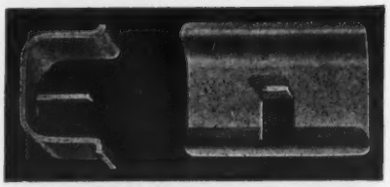
Matthews Wire Clips

It's a fallacy to think that Matthews Wire Clips are only used on guy wire to do away with the time and guy wire wasted serving above the guy clamp. For every Matthews Wire Clip sold for the purpose mentioned above 500 are sold for holding service drop wires. They save time and waste of twisting wires back on themselves. Make neater job as shown in photograph above.

The patented locking tongue shown in photograph below is inserted between the wire forming the loop and the clip is clamped tight over the insulation with pliers or wire connectors.

Thousands of Matthews Wire Clips are used in preference to serving stranded guy wire above the clamp. Save guy strand and make neater job in less time. The patented locking tongue prevents slipping. Made of galvanized iron, copper or aluminum.

Priced as low as $2.80 per 100. Write for free sample, prices and bulletin.



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ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.
Inspection—Analysis—Research—Certification
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48 Griswold St. Binghamton, N. Y.

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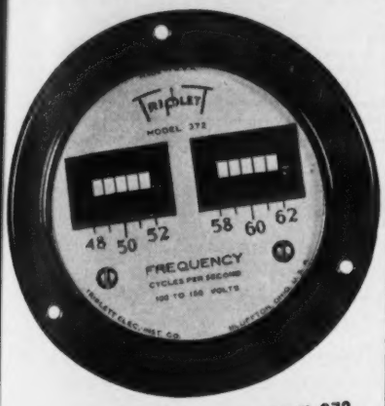

Vibrating Reed Frequency Meter. Illustration ⅔ actual size.

TRIPLETT MODEL 372

TRIPLETT

Deliveries under government requirements are facilitated by two large sub-contracting organizations combining to increase Triplett output.
TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO

HIGH GRADE
HARD PORCELAIN
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Electrical Specialties
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Watson to proceed immediately to Tallahassee to work against inclusion of Miami in such an act. Only three cities in the state now have charter regulatory powers over public utilities, Miami, Jacksonville and Tampa. A similar bill was introduced, exempting REA co-operatives and municipally-owned plants from its provisions. A constitutional amendment to exempt from ad valorem taxes the property and lines of the Rural Electrification Administration projects was defeated by the House after spirited debate.

OHIO—The bill to tax municipally owned public utilities, killed once by the House taxation committee (ELECTRICAL WORLD, May 1, page 119), has been revived in the Senate taxation committee. Mayor Frank J. Lausche of Cleveland headed a delegation of fifty officials of municipalities who opposed the bill. No action was taken. Fred Reiners of Cincinnati, who sponsored the measure, called attention to the increased amount of property that has become tax exempt in recent years. The federal government, he said, claims that $1,000,000,000 worth of industrial property financed by the federal government for war production in Ohio and $300,000,000 worth of government housing property should be tax free. He said his bill would tax about $50,000,000 worth of property owned by municipal utilities.

•

West Canadian Tied to West Kootenay

Making available additional hydroelectric power for British Columbia war industries, the power loads of two companies serving the Okanagon and vicinity are currently being synchronized. The arrangement has been made possible by a $650,000 construction program by West Canadian Hydro-Electric Corp., Ltd., which has more than doubled the capacity of its generating plant at Shuswup Falls. This new 3,500-kva. unit has now been thoroughly tested and is ready to make available to West Kootenay Power Co., Ltd., power to supply the entire south end of the Okanagan Valley.

•

Plans $719,688 Budget For New Construction

California Oregon Power Co. has announced that estimated capital expenditures for 1943 aggregate $719,688. The construction budget for 1943 includes improvements and replacements to hydro plants, $239,000; transmission line extensions and reconstruction, $136,000; substations, $49,000; electric distribution line extensions and reconstruction, $203,000; water distribution extensions and replacements, $52,000.

The company stated in its annual report that some of these projects may have to be postponed because of inability to receive the necessary material and equipment.

Figure Eight Double Tube Sleeve

Seamless Oval Type Sleeve

Split Tinned Sleeve for Underground Cables

This Precision Made Line of

Sherman Splicing Sleeves

Meets Every Requirement Of the Light and Power Industry - -

Sherman Splicing Sleeves make the finest of joints—strong, corrosion-free, and of highest conductivity. All sleeves made to accepted standards, stamped for identification, and carefully packed. Utilities the country over are today standardizing on Sherman Splicing because they provide maximum dependability at strictly competitive prices.

Write for Sherman Catalog illustrating the complete Sherman line of electric specialties and giving full specifications. Let us send you samples of material in which you are interested, for your own examination and test.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

BOOKS RECEIVED

Diesel and Gas Engine Power Plants. By Glenn C. Boyer. McGraw-Hill Book Company, New York. 447 pages, illustrated. Price $4.

Founded on Burns & McDonnell experience, the text is addressed to the designer and operator of plants rather than of engines, *per se*. Fallibility of transmission and of large steam-plants is said to give local generation its economic opportunity. Much A.S.M.E. and other operating data have been charted and analyzed for indexes of fuel consumption and upkeep and to account for wide differences in unit values. Costs are pre-war. Typical industrial and commercial projects are detailed as to load, engine auxiliaries and buildings. Ample technical data on fuels, lubrication, cooling are given along with design of exhausts, piping and waste-heat recovery. There are correlated chapters on the electrical layouts and units. Competitive agencies of power generation will find the data throughout the book helpful in arriving at economically justifiable decisions on alternatives.

Applied Electronics. By Members of the Staff of the Department of Electrical Engineering, Massachusetts Institute of Technology. John Wiley & Sons, Inc., New York. 772 pages, illustrated. Price $6.50.

Multiple authorship here results in logical sequencing of concepts so that electron tube phenomena and potentialities can be grasped in the broad area of electronics—radio is properly only a special province. Great pains have been taken to elucidate at the points where stumbling blocks arise unless forestalled. Principles are tied to practice by word, illustration and exercise and thus this intensive and comprehensive treatment becomes a guide to introduce a competent power engineer into the technology of the controlled electron.

Marine Electric Power. 2nd Edition. By Captain O. B. Newman, USCG. Simmons-Boardman Publishing Corp., New York. 238 pages, illustrated. Price $2.50.

By no means a treatise, nevertheless a basic approach to phenomena applied to propulsion. Basic because refreshingly unique in inverted approach from desired end-results to functioning principles of equipment. The beginner in electric powering will find understandable explanations not to be found in any orthodox presentations about motors, generators and controls.

Industrial Radiology. By Aucel St. John and H. R. Isenburger. Published by John Wiley & Sons Co., New York. 298 pages, illustrated. Price $4.

Enough quantum and radiation physics is included to lay the foundation for the technology of industrial radiology—tubes and circuits, fixed and portable installations and making the film record. Most pertinent, however, to practitioners are the chapters on interpretation of dozens of radiographs wherein the reader learns how to diagnose defects and ailments in fabricated metals and welded structures. Exographs of non-metallic objects are included as are gammagraphs by means of radium. An appendix gives penetration and absorption data along with apparatus and operating costs. The bibliography of over 1,300 items is manifestly ample in versatility of recorded practice.

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We are a relatively young but fast growing concern in the Middle West, specializing in transmission and distribution equipment. We have a small but most modern plant and a fine research department. We flatter ourselves for being aggressive merchandisers.

We are looking at present for an electrical engineer of resourcefulness to help us in the design of new equipment for the electrical utility industry. He should have some practical experience but mainly a lot of sound imagination and ideas.

To such a man we can offer a very satisfactory income, an excellent opportunity for promotion and a permanent connection with a financially strong organization.

If you feel you meet these qualifications and if you are not now in a full time war job, we wish you would write us. We might have just what you had always hoped for.

P-547, Electrical World
520 N. Michigan Ave., Chicago, Ill.

POSITIONS VACANT

DIVISION MANAGER—A company which has conformed to the intergration definition and is operating in a prosperous, rapidly growing territory desires an experienced division manager capable of taking complete charge of operating division containing approximately 21,000 electric customers. Knowledge of and experience in all phases of utility operations is essential with special emphasis upon ability to understand people and to operate in a manner sympathetic to the public interest. Prefer a man at least 40 years of age, experienced in utility operations in the South or Southwest. Territory contains good schools and colleges and living conditions are excellent. This is a permanent position with a solid company and should provide a lifetime of work. P-539, Electrical World, 520 N. Michigan Ave., Chicago, Ill

GOOD OPPORTUNITY for senior and junior grade engineers with some experience in electric, water and gas utility appraisal. Need working knowledeg of property accounting, work order procedure, invoice and payroll analysis, continuing property records. Much travel involved. Submit detailed education and experience. P-552, Electrical World, 330 W. 42nd St., New York, N. Y.

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SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. BIXBY, Inc., 262 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

MAN—age 38—20 years experience in Power plant, both steam and Hydro. Would like a position as manager or assistant manager of Hydro plant either private or municipal owned. Can give best of reference. PW-540, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER: Age 45 years, 24 years professional engineering experience, 20 years in the public utility field, 18 years in responsible charge of engineering work; at present employed as Assistant-Chief Engineer of Public Utility. Desires an engineering or executive position with utility or electrical manufacturer. PW-553, Electrical World, 330 W. 42nd St., New York, N. Y.

POST-WAR COLLABORATION:

British Engineering Company having three factories (light, medium, heavy) desires to collaborate with American Manufacturer/s for post-war production. Presently occupied electrical accessories, heavy air-blast switchgear, welded fabrications, and aircraft. Alternative lines of production to the above, Plastics, Air-conditioning, Small Compressors. Prepared to receive applications for spare time Electrical Engineering correspondent. Apply Box C 3058 c/o. **W. H. Smith & Son, Ltd., Manchester 3, England.**

POSITIONS WANTED

MANAGER—Wide experience all phases of local and territorial operation and management electric, gas, water, ice, heating, etc. Steam, hydro, and diesel. Public relations specialist. Past ten years with present connection. Satisfactory references. Would consider change where ability needed. Past draft age. PW-554, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

POSITION DESIRED — 29 years experience operating and chief engineer also management electric generating plants. 20 years present position, age 53, married, sober, good references past positions. 14 N. Marshall Ave., Springfield, Minn.

FREE BULLETIN

CLASSIFIED STOCK SUMMARY, 24 pages 5¼ x 8¼—indexed. Lists equipment offered for sale by several of the electric and gas utility companies, clients of Apparatus Exchange, Ebasco Services Incorporated, Two Rector Street, New York, N. Y.

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ANYTHING within reason that is wanted in the field served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

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MOTORS GENERATOR SETS

1—2000 Ampere, 6 volt, Hanson-Van Winkle.
1—1500 Ampere, 6 volt, Hanson-Van Winkle.
1—200 KW, 600 volt, GE, sq. cg.
2—250 KW, 250 v., GE Synch.
2—200 KW, 125 v., Wsgh., Sq. Cage.
1—100 KW, 125 v., GE Sq. Cage.
1—100 KW, 125 volt, Electric Products, syn.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 1200 RPM, 440-volt, GE, syn.
1—400 HP, 514 RPM, 440 volt, Westg, slip ring.
1—335 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 900 RPM, 440 Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sg. cg.

MOTORS—D.C. 230 VOLTS

1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—200 KVA, General Electric, 2200-220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, General Electric, 2200-220/110 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G. E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

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Complete Diesel Electric Power Plant 200 K.V.A. including panelboard, voltage regulator and transformers. Location South Carolina.

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1—AC Generator with Direct Connected Exciter 1600 RPM, 3 Wire-110 V, Single Phase, Ring Oiler Bearings, Large Switch Board Complete, GOOD CONDITION—Cost New $1200. Sale Price $450.00

1—AC Generator, Self Excited, Latest Model Columbia, Slt Used, Like New, Timken Roller Bearings—Single Phase, RPM 1200, 110-220 V, Switch Board Complete, Cost New $1250. Sale Price $650.00

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Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200
Rotary Converters—3 Ph. 25 Cy.				
2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600
M.G. Sets—3 Ph. 60 Cy.				
1—1500	G.E.	720	600	6600
1— 500	G.E.	720	600	13200

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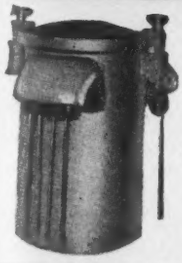
-TRANSFORMERS-



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SAVE TIME

Ever think what a time saver advertising is? In this issue you have helpful information from dependable manufacturers! Look each page over carefully—you may find the answer to your most pressing problem.

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

On d-c motor drives...

FAULT CURRENTS CAN BE KEPT LOW

This ultra-high-speed circuit breaker is so fast that fault currents can't rise to dangerous values.

ON PRESENT DAY d-c systems with generators, converters or rectifiers connected in parallel, fault currents rise so rapidly that serious damage may be done before a conventional circuit breaker can limit the current. Ordinarily the circuit breaker will open in 3 cycles, in special cases in 1½ cycles, but with fault currents rising at a rate of several million amperes per second, such opening times permit flash-overs to burn brushes and brush-holders. Damage is done; production is stopped for repairs or replacements.

ULTRA-FAST OPENING IS THE ANSWER

The way to protect a system against the effects of rapidly rising currents is to hold the peaks to safe values. I-T-E does this with fast-opening circuit breakers. The Type FB circuit breaker, illustrated, has opening characteristics which limit currents within 2/5ths of a cycle (60 cycle basis).

IMPORTANT SAVING OF MATERIALS

When high fault currents are to be encountered, bus structures must be built with heavy conductors and heavy bracing. On the other hand, when peak currents are kept low by ultra-fast circuit breakers, much metal is saved; buses are much simpler.

HIGH-SPEED CIRCUIT BREAKERS HAVE PROVED THEIR VALUE

I-T-E has high-speed circuit breakers in service. They are new but their record is well-founded. Our engineers will gladly tell you about them.

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

Putting the acid-forming hydrocarbon in its place

(or how to avoid turbine oil acidity)

Hydrogen and carbon atoms in petroleum are united in more combinations than you can shake a stick at. Although most of these unions are contented, some are not. They're unstable. They crave oxygen. When they get it, they change from benevolent Dr. Jekylls to murderous Mr. Hydes. Then look out for your turbine! Look for deposits, sludge, acidity, poor demulsibility, etc. Some of these oxidized hyd[illegible] tend to form asphaltenes, others to form acids. Particularly devil[illegible] that become acidic. These cause or contribute to abo[illegible] turbine oil trouble there is. They gripe oil men becau[illegible] all be removed by any refining process yet discovered. Some of the[illegible] the oil, in spite of all that science has been able to do. Here is where Nonpareil Turbine Oil affords a great and unique advantage. It contains a patented inhibitor. Because of this inhibitor, all acid-forming hydrocarbons are locked up and rendered incapable of doing harm. As a result, we are able to give a written guarantee that Nonpareil's acidity (as expressed by neutralization number) will never exceed 0.15. In service, it is more likely to be around 0.05, as hundreds of turbines have proved after 5 to 16 years of operation. How we eliminate trouble from both asphaltenes and acids will be told next month. Meanwhile, if you want further information, send for a Standard Lubrication Engineer.

Write or phone the nearest Standard Oil Company (Indiana) office, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, Standard Oil Company of Nebraska, at Omaha.

NONPAREIL TURBINE OIL

Oil Is Ammunition . . . Use It Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING